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BRIEFLY TOLD.

THE DEPRESSION IN GAS SHARE VALUES.—The prevailing condition of the general securities market is one of uneasiness and distrust, and the latter characteristics have been taken advantage of to the full by the professional dealers, who care little whether prices reflect intrinsic values or not, as long as a profit inures from their day-to-day transactions. Nor does it matter to them whether the profit is in the long or the short of it; profit is what they are seeking, and quick turns suit them to a nicety. Of course, no one who looks beyond the current hour can deny that the general financial situation is serious, for the second of the great political parties of the country has unconditionally declared for a bimetallic standard, wherefore the disruptionists and their policy must have earnest consideration, in that they can count upon the aid of many who, in their best beliefs differing from the tenets of the current Democratic shibboleth placed before them, through party fealty will place party above reason and vote for the disruptionists. Certainly, in time all this blind adherence to party would be corrected, but the time taken up in the correcting would be all too long to prevent initial disaster. So it looks that investors to be successful must be prudent and conservative—in fact, even in normal times and under normal conditions, prudence and conservatism are the guiding genius of investment—but it appears that in the present craze to sell, prudence has been lost in the desire to turn into money pledges that are better than the money itself. Under these circumstances it is nothing for wonder that the professional trader is "short" to-day and "long" to-morrow, since he confidently trusts that the marking down of the one day will be sure to bring out from timid holders sufficient stock at the decline to enable him to market it on the other day at a profit, fractional though it be, ample to induce him to repeat the operation. Meanwhile, however, the net result of these daily speculations is to carry the shares operated in to lowering levels, that usually remain too long as the intrinsic value representation. These remarks are prompted by a correspondent, who inquires our opinion respecting the value of a named city gas security, and we take this opportunity of saying that, no matter what the outcome will be of the present contest over monometallism or bimetallism, he who owns any of the gas shares of the metropolitan districts of the country will, in the long run, not be a sufferer by holding on to the same, no matter at what figure the shares were purchased. We hear on all sides the remark that gas share values in this city have been roundly smashed, because of the reigning political financial quandary, and in refutation thereof we submit the quotations for the four named Companies' common shares, as follows:

Company.	Quoted Value, Aug. 5, 1895.	Quoted Value, Aug. 1, 1896.
Consolidated	142 to 143¾	142 to 143½
Equitable	193 to 195	190 to 198
Mutual	170 to —	215 to 220
Standard	64 to 67	73 to 75

These figures we submit are proof eloquent, no matter what the condition of the general share market is, of the increasing value and stability of the properties behind the gas shares of New York, and the same verdict really applies to the shares of every well-managed gas company in the country.

THE AMERICAN AND THE ENGLISH PRACTICE IN A MONEY UNIT FOR PREPAYMENT METERS.—In the issue of the *Gas World* for July 18th, referring to the question, "Is the penny-in-the-slot meter really required?" it is stated, notwithstanding the fact that hundreds of thousands of these meters have been placed in England during the past five years—which would appear to be convincing proof that they are required and have served to fill a long-felt want—the answer has not always been given in the affirmative; on the contrary, the answer has quite frequently been an emphatic "No." In describing a reason for this disparity in opinion, the point is made that, in all probability, the adoption of the penny as the operating medium has been a mistake. This latter coincides with our view of the situation, and leads us to a comparison of the system generally followed by American manufacturers of slot meters as against that in vogue in England. In this country the standard adopted is usually that of the quarter dollar, a coin which, on account of its fractional value, and its relation to the even divisions upon which rates for gas are usually based, assures to the consumer a measurably large supply of gas for his immediate needs, and thus satisfactorily fulfills the purpose for which the coin meter was primarily designed. It is hardly reasonable to suppose that a consumer who would place his limit below that of the American quarter, or of the English coin most nearly approaching it in value, the shilling, is one that could ever prove profitable to a gas company, let the established rate for gas be as low as it may; neither is it likely that such consumer would make his convenience subservient to his desire to burn gas, and undertake frequent trips to the cellar or other equally inaccessible place in which the meter may be placed, to deposit smaller coins for the needed gas supply. Hence it is that we are led to believe that the student, in a measure, at least, has outstripped his master, and that our English brethren could profitably adopt the course followed by our home manufacturers, and make the smallest denomination of coin to be employed in the coin meter their shilling piece. We believe this course would forever set aside any objection, other than the usual mechanical defects, that might be set up against their instruments, and would eventually prove to be a move in the right direction.

NOTES.—At the annual meeting of the Fitchburg (Mass.) Gas and Electric Company the following officers were elected: Directors, Rodney Wallace, Chas. T. Crocker, Francis B. Shepley, Herbert I. Wallace, Chas. E. Ware, Henry T. Page and George E. Clifford; President, Rodney Wallace—his 32d consecutive term; Clerk, Treasurer and General Manager, Henry F. Coggshall—his 43d consecutive term.——Last week we noted the renewal by the City Council of the franchise for the Sedalia (Mo.) Gas and Fuel Company for a period of 30 years. We also gave the schedule of rates specified, but as our report was slightly in error, we repeat the same as they are to actually rule: For the first 7 years, $1.80 per 1,000 cubic feet; for the next 8 years, $1.50 per 1,000; for the remainder of the life of the ordinance (15 years), $1.25 per 1,000. Prompt payment is to entitle the consumer to a rebate of 10 per cent. The current rate for gas used for fuel is $1.50 per 1,000, net.——It is said that Mr. J. E. Addicks has purchased the plant and properties of the New Castle (Del.) Gas Company.——The works of the Hempstead (L. I.) Company are to be remodeled, more especially in the instance of the carbonizing department.——Mr. T. J. Cannon has applied for the appointment of a receiver for the properties of the United States Electric Light and Power Company, of Baltimore, Md., and Judge Ritchie directed the defendants to show cause, by the 10th inst., why a receiver should not be appointed.——The Peoria (Ills.) Gas Light and Coke Company has entered suit against the T. B. Townsend Brick and Constructing Company for $5,000 damages. The suit is the result of a contention between the parties regarding loss sustained by the Gas Company to its mains through the negligence of defendants while constructing a sewerage system in a certain district of the city. The Peoria Water Company also has a suit, based on similar lines, against the Townsend Company.——Work on the reconstruction of the plant of the Independence (Mo.) Gas and Coke Company is underway.

VALUE OF PETROLEUM AS A MOTOR.—Sir David Salomon, in giving evidence before the Select Committee inquiring into the working of the English Petroleum Acts, which was presided over by Mr. Mundella, is reported to have said that, as a civil engineer and belonging to a number of other scientific bodies, he wished particularly to point out the value of petroleum as an agent for the propulsion of motor cars. His experience showed that petroleum of the lowest flash-point would be extremely useful for this purpose, that quality being much better for horseless carriages than oil of a high flash-point. He also declared that he considered there was every sign of these vehicles coming into immediate use, but that they were not so likely to be used for personal locomotion as for carrying.

Cyanides from Bye-Products.

[From the *Journal of Gas Lighting*.]

At the meeting of the Gas Engineering Society, held, by permission of the Governors, at the Goldsmith's Institute, New Cross, London, July. 8th, Mr. A. G. Bloxam, F.I.C., Professor of Chemistry at that establishment, read a paper on "Cyanides from Bye-Products." Mr. Frank Livesey, the Chief Engineer of the South Metropolitan Gas Company, presided.

The chairman, in a few opening remarks, said it was not necessary for him to introduee Mr. Bloxam to the members, because he was already so well known in connection with work of this kind. He (Mr. Livesey) was present, like the rest, to learn something about this very interesting subject, because now that gas companies were manufacturing more gas they were producing more coke and ammonia, and other people were also joining in. Therefore, they were not making coke and ammonia in accordance with the demand, but they made these products in accordance with the demand for gas. In this way their production was not carried on strictly upon ordinary commercial business principles. The position was therefore this: There was a great deal too much coke in London for the requirements; and he supposed he might say the same of ammonia, seeing that it was selling at $65 per ton about eigh een months ago, and now they could not get $40. This was evidence, he thought, that there was over-production. Also in regard to tar, he could not say there was a very bright prospect, though one of the products of this residual—benzol—had lately been selling well. Taking these things into consideration, they had to look afield to see if they could not find something else to bring in a little more money to the till. This was all the more necessary because they had a very serious competitor in the electric light; and the prosperity of gas companies depended upon the selling of gas cheaply. Therefore, it was necessary that all connected with gas works should exert themselves to bring in a new product. The question to be dealt with by Mr. Bloxam had come to the front lately in consequence of the use of cyanide in the extraction of gold; and while the mines were busy in the Transvaal, it gave a spurt to the demand for it. For the present it had fallen back a little, in consequence, he supposed, of the disturbances in South Africa. There was no doubt the material would be required for some time to come; and it would be very largely used if it got a little cheaper. Ferrocyanide of soda, he was told, had come down to 9 cents per lb., while it had been selling at 25 cents. Still, he believed they could make a little profit from this new branch of business. He was at work on it himself; and therefore he was much interested in the subject. He must, however, confess that he knew Mr. Bloxam could enlighten him on the chemical part of the subject. They must look to gentlemen such as Mr. Bloxam to help them further, for he was sure there were many improvements to be made in gas manufacture in which chemists could assist them—for instance, there was the question of carbonizing. They put the coal into the hot retort, which immediately brought down the temperature; and this represents a very considerable loss. They were thus producing gas at the beginning of the charges at a comparatively low temperature; whereas at the end, the temperature (as in all things connected with gas works) was greatly increased. This was a point that had not been investigated so much as it ought to be, and when it was he believed they would find out something which would be very beneficial.

Mr. Bloxam proceeded to read his paper, various portions of which he enlarged upon and illustrated by experiments.

The first part of the paper dealt generally with the origin and practice of the potassium cyanide process in the extraction of gold; the successful application of this chemical to the work having, remarked the author, widely extended its market. Mr. Bloxam then proceeded: I regret that I have no data at hand to enable me to form an estimate of the position of British trade in cyanides. I learn from a consular report that in 1892 Germany exported to the Transvaal 1,658 cwt. of potassium cyanide, valued at $56,860, while in 1895 the figures were 18,484 cwt. and $735,000 respectively. It is to be feared that the figures for the United Kingdom would not be so favorable, and I am afraid that the backwardness of our gas industry in the matter is one reason for this.[1] Potassium cyanide is to-day quoted at 29 cents per lb., ammonium sulphate at $40 per ton—*i.e.*, a little under 2 cents per lb. Since they contain nearly the same percentage of nitrogen, this is also approximately the ratio of the value of the nitrogen in them. The cyanide

1. Since writing the above Mr. Bloxam has been informed by a dealer in cyanides that he is of the opinion that the British trade is quite comparable with the figure quoted for the German trade.

must always be more costly to recover than ammonium sulphate, but certainly not fourteen times as costly.

The basis of all cyanides is the gas cyanogen CN, or more correctly C_2N_2. It may be said that the prime difficulty of producing cyanides resides in the fact that cyanogen is more energetic, weight for weight, than a mixture of carbon and nitrogen in the proportion in which they exist in the compound. Thus it happens that, in order to produce cyanogen from its elements, energy must be imparted to them. Hence carbon cannot be made to burn in nitrogen save at heat pressures (temperatures) sufficiently high to ensure the introduction of the necessary energy into the system. In burning carbon in oxygen, a compound—carbonic acid—is produced which is less energetic, weight for weight, than is a mixture of its elements in the proportion in which they exist in the compound. So that, when causing carbon and oxygen to combine, we are, as it were, drawing upon their current accounts at the energy bank—a process notoriously more easy than its converse. It has been alleged that cyanogen is produced in small quantities when electric sparks are passed between carbon electrodes in an atmosphere of nitrogen, but beyond this the direct combination of carbon and nitrogen does not appear to have been observed, unless we admit that the formation of cyanogen in the blast furnaces arises from direct combination of its elements, a point which is, to my mind, open to considerable doubt.

Cyanogen is what is termed an acid gas—*i. e.*, it has a powerful affinity for alkalies, like potash, soda, lime, and baryta; so that it combines readily with these. If, therefore, one of them be present when carbon and nitrogen are very strongly heated together, it encourages the formation of cyanogen by immediately combining with the gas, when it is formed, to produce a cyanide. For example, it has been found to be possible to make barium cyanide, $Ba(CN)_2$, by passing nitrogen through a retort in which a mixture of barium carbonate and pitch is being heated at about 2,500° F. This indisposition of nitrogen to enter into direct union with carbon is typical of the behavior of the element towards the majority of its colleagues. Now when an element shows this idiosyncrasy, it is necessary to have recourse to indirect methods of producing its compounds; and these methods are generally based on the fact that it is, in such cases, easier to transfer the element from one form of combination to another than to induce its direct combination. Better yields of cyanide, for instance, are obtained by substituting ammonia for nitrogen in processes of the type mentioned above. At one time, such a substitution was not to be thought of, since the sole desire of the inventor was to produce cyanide as an intermediate product in the manufacture of ammonia from atmospheric nitrogen. Now, however, the scene has shifted; and there are few producers of ammonia who would not gladly convert a portion of it into cyanides, pending the inevitable fall of prices. It has long been believed that when an alkali is heated with carbon and nitrogen or ammonia, no appreciable quantity of cyanide is formed below the temperature at which the carbon can deprive the alkali of its oxygen—liberating the alkali metal, which then combines with another portion of the carbon and with nitrogen to form the cyanide. If this be the case, it were better to substitute a previously prepared alkali metal for the alkali, since a lower temperature might then serve. Accordingly, in Castner's process, by which, I believe, sodium cyanide is now being produced in Birmingham, metallic sodium is caused to flow down a column of heated coke, up which ammonia is passing.

After a reference to waste animal matter—such as blood, horns, leather, and the like—as a convenient source of nitrogen for preparing cyanides, the author continued: Besides the cyanides and ferrocyanides, cyanogen is also in slight demand in the form of sulphocyanides, chiefly potassium sulphocyanide, KCNS. This compound is easily formed by adding sulphur to molten potassium cyanide; but it is more cheaply prepared by taking advantage of the fact that, when ammonia and carbon bisulphide are heated together at about the temperature of boiling water, preferably under pressure, ammonium sulphocyanide is formed, thus—$CS_2 + 4NH_3 = NH_4CNS + (NH_4)_2S$. In practice, it is economical of ammonia, and at the same time diminishes the pressure in the apparatus, to add lime to the charge, so that the final products are calcium sulphocyanide and sulphydrate—

$$2Ca(OH)_2 + 2CS_2 + 2NH_3 = Ca(CNS)_2 + Ca(SH)_2 + 4H_2O.$$

The calcium sulphocyanide is convertible into the potassium salt by treatment with potassium carbonate—

$$Ca(CNS)_2 + K_2CO_3 = CaCO_3 + 2KCNS.$$

The process becomes of much importance in connection with the possibility of desulphurizing the sulphocyanide so as to obtain potassium cyanide.

I have now laid before you the chief methods by which carbon and nitrogen may be brought into combination for the South African market. I need hardly say that, since the demand originated, patents for the production of cyanides have been very numerous; the 1895 crop including no fewer than 33 specifications, as against 7 in 1892, which was the most prolific year since 1886. The gas industry has the great advantage over other producers that cyanogen is formed as an essential part of the destructive distillation of coal, and it is for the gas engineer to consider carefully whether means may not be adopted either to so increase the yield or to so decrease the cost of recovery that even the smallest gas works may contribute its quota of cyanides as it does of ammonia—thus driving all other competitors from the field. Nothing but diligent study of the subject, followed by due experimentation, can achieve this end; and it behooves us in the first place to consider what is known with regard to—(1) The origin of the cyanogen during carbonization; and (2) the forms and localities in which the cyanogen appears during the process of purification.

Two possibilities present themselves in connection with the origin of the cyanogen. It may be formed (*a*) as a secondary product, resulting from the interaction of the gases during their sojourn in the retorts, or of these with the hot coke; or (*b*) as a primary product, resulting from the break-down of some nitrogenous compound in the coal. The majority of investigators seem to have viewed the first of these two possibilities as the more probable, and have sought to obtain cyanogen on a small scale by bringing together at high temperatures such gases as are known to be present in the retort, either in the presence or absence of charcoal or coke. Experiments of this kind have recently been repeated by Bergmann, who has corrected certain errors of former observers. He finds that, when ammonia is led through a tube containing charcoal heated at 1,000° C. (approximately the temperature of the gas retort) hydrocyanic acid (not ammonium cyanide, as heretofore stated) is produced; such portion of the ammonia as is not thus converted being decomposed into nitrogen and hydrogen. The yield is increased if the ammonia be diluted with coal gas—a condition obtaining in practice—although this does not seem to be due to any interaction between the ammonia and the gaseous carbon compounds. I can, however, state from my own experience that coal gas and ammonia will give rise to hydrocyanic acid at temperatures decidedly below that of the gas retort. The reaction between coke and ammonia may be expressed by the chemical equation $C + NH_3 = HCN + H_2$, and is one which may be considered likely to occur in the retort. Bergmann has discredited the view that carbonic oxide and ammonia react in the retort in accordance with the equation—

$$CO + NH_3 = HCN + H_2O;$$

for he finds that this change takes place to a very limited extent even at 1,100° C. I have myself recently tested a third view—viz., that ammonium sulphocyanide may be formed in the retort by the interaction of carbon bisulphide and ammonia—

$$CS_2 + 2NH_3 = NH_4CNS + H_2S.$$

I find that, in the presence of hydrogen, ammonium cyanide is the product of this reaction, not sulphocyanide. This is in agreement with Knublauch's statement that crude gas contains no sulphocyanogen. If the cyanogen be, in fact, a product of the attack of the hot coke by the ammonia, its formation should be in some measure dependent on that of the latter. Experiments are wanting to show at what stage of the distillation the cyanogen chiefly appears. Is it really the high temperature product that the above view of its formation would imply, and Lewis T. Wright's experiments seem to show? If not, then the possibility that it is a primary product of the distillation will be favored.

The cyanogen leaves the retort in the form of hydrocyanic acid; ammonium cyanide not being capable of existence at temperatures above 36° C. It constitutes about 0.1 per cent. by volume of the gas—say, from 75 to 100 grains per 100 cubic feet. The nitrogen in it represents about 1.5 per cent. of that in the coal, or 0.023 per cent. of the weight of the coal. Supposing that all this were recovered as potassium cyanide, there would be obtained about 1 ton per 1,000 tons of coal.

Following the destiny of the cyanogen, we have first to consider the liquor in the scrubbers and washers. It is rather surprising that no ammonium cyanide occurs in this liquor, since there is an abundance of ammonia with which the hydrocyanic acid might combine, and the temperature is below that at which ammonium cyanide can exist. It can only be supposed that, in the struggle which occurs between all the acid gases present for the ammonia, the hydrocyanic acid comes off worst, and is compelled to move on. Nevertheless, ammonium sulphocyanide and ferrocyanide do occur in the liquor. The ferrocyanide is

probably formed by the action of the hydrocyanic acid on ferrous sulphide in presence of the ammonia—

$$6NH_4CN + FeS = (NH_4)_2S + (NH_4)_4FeC_6N_6.$$

The iron sulphide would, of course, originate in the ironwork of the condensers and washers. The presence of sulphocyanide is not quite so easily accounted for. It has been suggested that a small quantity of oxygen in the coal gas oxidizes some of the ammonium hydrosulphide in the liquor, forming ammonium persulphide, which then combines with the HCN to form sulphocyanide—

$$(1)\ 2NH_4HS + O = (NH_4)_2S_2 + H_2O.$$
$$(2)\ (NH_4)_2S_2 + HCN = NH_4CNS + NH_4HS.$$

It is possible, however, that the sulphocyanide, or a part of it, is a product of the interaction of carbon bisulphide and ammonia in the washer, according to the equation that has already been given. In this case, the cyanogen of the gas is in no way responsible for the sulphocyanide. On this account, it is difficult to say what proportion of the cyanogen which leaves the retort is retained in the washing liquors. The same remark applies to the calcium sulphocyanide found in the lime; for, when ammonia escapes the washers, it reacts with the carbon bisulphide in the lime purifiers. In the ordinary course of purification, the iron oxide undoubtedly retains the largest proportion of the cyanogen, particularly when oxide vessels precede the lime. The current opinion is that the hydrocyanic acid forms a ferrous cyanide by reacting with the ferrous sulphide in the oxide purifier—$FeS + 2HCN = Fe(CN)_2 + H_2S$. When the oxide is revivified, this ferrous cyanide becomes oxidized to prussian blue (ferric ferrocyanide)—

$$9Fe(CN)_2 + O_3 = Fe_4(Fe_6CN_6)_3 + Fe_2O_3.$$

The blue accumulates in the purifying mass until the spent oxide contains several per cents. of the pigment.

In Germany, hydrated ferric oxide is more frequently used in the first purifiers than it is in this country, hence spent oxide is there much worked for the sake of its cyanides. A masterly paper by Knublauch deals with the conditions necessary for producing spent oxide containing the maximum quantity of prussian blue. Unless these conditions be fulfilled, much of the cyanogen appears in the spent oxide as sulphocyanide, which is less easily dealt with. The chief desideratum is the complete removal of ammonia before the gas passes into the purifier, since the ingredient encourages the formation of sulphocyanide. Under these circumstances, the oxide should take up cyanogen equivalent to from 17.5 to 21.0 per cent. of potassium ferrocyanide, calculated on its dry weight, before it is spent; and this amount should represent some 66 per cent. of the cyanogen leaving the retorts. Leybold has stated that it is well to use as the first purifier an oxide vessel which has ceased to take up sulphur, and is sufficiently large to entail slow passage of the gas.

It is now necessary to consider what means are at present available for recovering the cyanogen from the bye-products. We have seen that it is present in two forms—viz., as sulphocyanide (of ammonium) and as ferrocyanide (of ammonium and of iron); and that it is possible to favor, to a certain extent, the formation of the latter at the expense of the former. We shall see presently that the whole of the cyanogen may be obtained as ferrocyanide or as sulphocyanide by altering the present system of purification, in the one case to a small extent, in the other radically. But first the method available without any alteration of the present system, except perhaps a shift of purifying vessels, demands attention. Cyanides have for many years been made in Germany from spent oxide, and in this country two firms, I believe, are at the present time engaged in the work. Details of the processes adopted are not made public, but the following chemical principles are applied: The prussian blue in the spent oxide is insoluble in water, while the ammonium sulphocyanide is exceedingly soluble. Consequently, extraction with warm water will remove the sulphocyanide, and when other soluble salts are present but in small amount, the aqueous solution may be evaporated to recover the sulphocyanide. In other cases, resort may be had to the insolubility of cuprous sulphocyanide, CuSCN, which is precipitated as a white powder when sulphurous acid and copper sulphate are added to a solution containing a sulphocyanide. The cuprous salt may be converted into the potassium salt by boiling with potassium carbonate—

$$2CuSCN + K_2CO_3 = Cu_2O + CO_2 + 2KSCN.$$

After the removal of the sulphocyanide, the mass containing the prussian blue is dried, mixed with caustic lime, and heated in closed vessels by means of steam. In this way, calcium ferrocyanide is formed—

$$Fe_4(FeC_6N_6)_3 + 6CaO = 3Ca_2FeC_6N_6 + 2Fe_2O_3.$$

This salt is soluble in water, and is accordingly leached out. To convert it into potassium ferrocyanide, potassium chloride is added to a boiling solution of it, whereby the insoluble calcium potassium ferrocyanide, $CaK_2FeC_6N_6$, is precipitated. This compound is then boiled with potassium carbonate to complete the conversion, the calcium being converted into the insoluble carbonate—

$$CaK_2FeC_6N_6 + K_2CO_3 = CaCO_3 + K_4FeC_6N_6$$

The solution of potassium ferrocyanide is evaporated to obtain the crystallized salt, $K_4FeC_6N_6 3H_2O$.

In the case of the ammoniacal liquor the recovery is somewhat simpler, since the ferrocyanide is already in a soluble form. The residues from the ammonia stills contain the sulphocyanide and ferrocyanide in the form of the calcium compounds, since the lime which has been added to expel the fixed ammonia has taken its place in the two salts. The sulphocyanide may be separated, and the ferrocyanide converted into the potassium salt, in the manner already described.

It was suggested by Knublauch that a more rational way of dealing with cyanogen in gas manufacture than the present method would be to convert the whole of it into ferrocyanide directly, by taking advantage of the fact that, in the presence of ferrous sulphide and an alkali, hydrocyanic acid is converted into the ferrocyanide of the alkali. The conditions can readily be obtained by adding an iron salt to the water in the washer, for this is certain to be alkaline from the presence of ammonia, while the added iron will at once become ferrous sulphide by the action of the ammonium hydrosulphide. I have not perhaps laid sufficient stress upon the point that, although ammonium cyanide is incapable of existence in the presence of the large quantities of sulphureted hydrogen and carbonic acid which pass through the washer, ammonium ferrocyanide holds its cyanogen so much more firmly that it is stable in the presence of these gases. The recovery of ferrocyanide from the ammoniacal liquor, if this process be adopted, will be carried out as already indicated. Diverse forms of iron have been suggested as convenient for introduction into the washer for this process, but I am not aware that anyone of them has particular claim for preference, except on the ground that, if the iron be introduced in the form of a salt, the acid radicle of that salt will render fixed an equivalent portion of the ammonia in the liquor—thus diminishing the so-called free ammonia.

It is, I think, an obvious improvement of this plan to effect the absorption of the hydrocyanic acid, not in the washer itself, but in a small subsidiary one inserted after the main washer, and to introduce caustic soda and the iron salt into this vessel. The advantage will be obtained that sodium ferrocyanide will be directly produced, and the proportion of free to fixed ammonia in the main washer will not be disturbed. The sodium salt can then be obtained by direct evaporation of the liquor. This is, I believe, the essence of a process for which a patent has been claimed; ferrous carbonate being the particular form of iron employed. There is no special virtue in using ferrous carbonate; but there is an advantage in robbing the iron salt of any fixed acid radicle before introducing it into the washer, since it is undesirable to have to separate a soluble sodium salt from the ferrocyanide.

It will be noted that the methods just dealt with recover the cyanogen in the form of ferrocyanides. Now, it will be clear from what was said at the beginning of this paper, that the modern demand is not for ferrocyanides, but for cyanides. Unfortunately there is an inherent difficulty, which I have attempted to explain, in the recovery of the cyanogen directly in the form of cyanides, and, as a result, every pound of cyanogen which is taken from the gas retort to South Africa must go through the form of either ferrocyanide or sulphocyanide. This being the case, the question naturally arises, Which is the less thorny path to follow? "By way of ferrocyanide," would have unhesitatingly been the answer until a few years ago; but now a doubt arises. Potassium ferrocyanide can be converted into cyanide by mere ignition out of contact with air, but not without the loss of a third of its cyanogen, as shown by the equation $K_4FeC_6N_6 = 4KCN + Fe + C_2 + N_2$. This loss is largely prevented by adding potassium carbonate to the ferrocyanide before ignition, whereupon five-sixths of the cyanogen becomes cyanide, and one-sixth an oxidized product, potassium cyanate, KCNO—

$$K_4FeC_6N_6 + K_2CO_3 = 5KCN + KCNO + Fe + CO_2.$$

This cyanate is useless; and it is, therefore, sought to suppress it by adding charcoal to the charge—

$$KCNO + C = KCN + CO.$$

Pretty as these equations are, they are, I fear, seldom quantitatively realized. It has therefore been proposed to melt the ferrocyanide with sodium; thus obtaining a mixture of KCN and NaCN good enough for the miner's purpose—

$$K_4FeC_6N_6 + Na_2 = 2NaCN + 4KCN + Fe.$$

Sodium or potassium sulphocyanide merely needs the removal of sulphur to convert it into cyanide. It seems that success is likely to attend a method consisting in heating the sulphocyanide with zinc; thus removing the sulphur as zinc sulphide—

$$KCNS + Zn = KCN + ZnS.$$

If this be the case, it may be better to attempt the recovery of the whole of the cyanogen as sulphocyanide in the gas industry, particularly in view of the possibility of somewhat increasing the yield at the expense of the obnoxious carbon bisulphide and of some of the discredited ammonia, as mentioned above.

If the cyanogen be preferably recovered as sulphocyanide, then I see no better plan at present than that which was suggested in the Claus process for purifying coal gas. With the process as a whole I have nothing now to do. The principle contained in it to which I would call attention is the conversion of a portion of the ammonium hydrosulphide, NH_4HS, into bisulphide $(NH_4)_2S_2$, by dissolving sulphur in it and then using this as an absorbent for the HCN, producing sulphocyanide, thus—

$$(NH_4)_2S_2 + HCN = NH_4CNS + NH_4HS.$$

Nothing is easier than to write this reaction on paper and to suggest that it could be effected in a subsidiary washer!

In this paper I have endeavored to put before you some of the reasons why we should bestir ourselves concerning cyanides, some of the biography of gas retort cyanogen, and some of the principles underlying the recovery processes. My apologies are due to you that it is not more succinct and not more complete.

On the proposition of Mr. G. P. Lewis (the Chairman of the Society), seconded by Mr. C. Tanner, Jr., a cordial vote of thanks was passed to the author of the paper.

Mr. Bloxam, in responding, mentioned that Dr. C. A. Doremus, Professor of Chemistry at the City College, New York, was present, and could give the members some interesting information upon matters relating to gas supply in America.

Gas Works Practice in New York.

Dr. Doremus, on the invitation of the Chairman, said that gas works practice was so utterly different in England from what it was in the United States that he was present that evening to learn something about the methods in use here for regaining valuable bodies from the waste products. In New York, he supposed that, of the output of gas, quite three-quarters was oil gas with a base of water gas. The temperature of the retorts was very nicely controlled in the manufacture of oil gas by the use of oil fuel. In some of the largest gas works the fuel oil, or more particularly gasoline, was allowed to trickle into the retorts; and these were kept at a constant temperature day in and day out. The output was therefore very uniform; and since they found this enriched gas had a very high heating co-efficient, it was used not only for lighting but for heating. They gave a pressure of 7 to 5 inches in the mains. This was very excessive; and there was, in consequence, a considerable amount of leakage. But all the companies had been obliged to give a high pressure, on account of the great consumption of gas for fuel, which was increasing constantly; and in order to overcome the leakage they were now using wrought iron or steel pipes, with screwed joints. They had almost entirely given up the use of cast iron and lead pipes. The introduction of acetylene, through the production of calcium carbide, was going to make some changes in their gas production on the other side, as it might eventually do here. As yet they had not been able to produce with the acetylene alone an illuminating gas for service. They found they could not increase the illuminating power of water gas even by adding acetylene in considerable quantity, though added in smaller proportions to coal gas it did very well. Attempts were going to be made—especially if calcium carbide became a really commercial article—to use acetylene in connection with the hydrogen of water gas to produce olefiant gas; and thereby they would get almost any illumination, and a gas that would be much more manageable. The average illuminating power of New York gas was 25 candles. The introduction of the Welsbach light was extending very rapidly in all directions. With regard to the recovery of products such as Mr. Bloxam had dealt with, they were as yet doing very little; but the competition of the electric light was making the companies keener in that respect.

Dr. Doremus was thanked for the interesting particulars he had given, and this concluded the proceedings.

The Method for the Use of Standard Candles in Photometry.

By Mr. Clayton H. Sharpe, in *Physical Review*.

The fundamental assumption on which is based all American and English practice in the use of candles as a standard of light in photometry is that the intensity of light emitted by a candle is, within certain arbitrary limits, proportional to the rate at which the material of the candle is consumed. Supposing this assumption to be in a measure justifiable, we could scarcely imagine it to be rigorously exact. The purity and hygrometric state of the air, which Liebenthal has recently shown to have such a large influence on the intensity of the Hefner light, can scarcely be of inappreciable influence on the candle flame. But no matter how nearly this assumption approximates to the true state of affairs, the fundamental and inevitable difficulty with this definition of the light unit still remains. It is this: What we ought to know is not the mean rate of consumption during the period over which the measurements extend, but the rate at the instant at which a photometer setting is made. Since it is impracticable to determine this quantity, the mean rate has been used for correcting observations. That this cannot be a proper method of procedure, on the assumption made, is shown by a study of the enormous and quick variations to which the quantity of light emitted by a candle is subject. Curves showing these instantaneous variations have been obtained by the use of a sensitive bolometer, which, when exposed to the radiation of a candle flame, would respond to every change in the intensity of that radiation. It is quite possible that a series of photometric settings should be made in such a way that their mean would give a value considerably lower than the mean ordinate of an intensity curve covering all the time between two weighings of the candle. Moreover, in the bolometric investigation it was found that corrections to the mean ordinates of the various curves for deviations from the normal rate of consumption did not serve to reduce these ordinates to a common value; or, in other words, that the energy radiated was not proportional to rate. Since the radiant efficiency of a candle flame does not change with its size, provided that it does not smoke, this would be true for luminous radiation as well as for total radiation. This is in accord with the observations of Tyndall, and the results of Von Jolly, who showed that on a mountain summit candles have a shorter flame and diminished intensity with the same rate of consumption. Recognizing these facts, the German photometrists have insisted that the flame height is the significant factor, and that candle measurements should be made only with a standard height of flame. They would clean the wick of the candle, wait until the flame height becomes normal, and then set the photometer. There are certain objections to this method of procedure, although it undoubtedly gives better results than the English practice. In the first place, it must be a time-wasting and patience-trying operation. Moreover, it is very doubtful if snuffing the wick of a standard candle is an allowable operation, since the shape of the flame depends on the particular curl which the wick assumes, and is normal only when the wick has its natural curl. A more desirable method would be to measure, at the instant the photometer setting is made, the height of the candle flame; then, knowing a relation between the height of the flame and the intensity of light emitted, to reduce the instantaneous intensity to the intensity at normal flame height.

Intensity and Height of Flame.—The first question, then, becomes: Does any definite relation exist between these quantities? Giroud has shown that the slender, pointed flame of his bec-bougie varies at the rate of about 2 per cent. per millimeter, the relation between flame height and intensity being nearly linear. Liebenthal has drawn curves

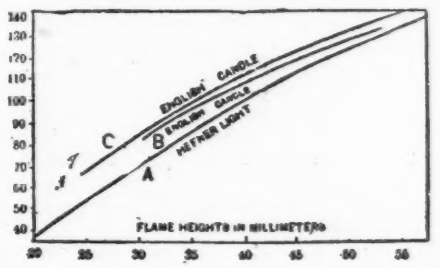


Fig. 1.—Curves by Liebenthal.

showing this relation in the case of the Hefner lamp and of the English standard candle (Fig. 1). For the former the relation is approximately linear for small variations, and shows, for variations between 35 mm. and 45 mm., 2.6 per cent. per millimeter. The two English candles tested are practically straight lines for all ordinary variations, and show 2.1 per cent. and 1.9 per cent. per millimeter, respectively, for variations between 40 mm. and 50 mm.

The present experiments were suggested by the results of the bolometric tests of candles. They were undertaken, first, for the purpose of investigating this relation between the flame height and intensity, and, second, to determine whether the use of this relation would not make

it possible to get more consistent results than can be obtained by correcting for rate of consumption.

Two methods were employed to determine the flame height intensity ratio. In the first method the intensity of the radiation of the candle was measured by the bolometer in the way previously described. To measure the height of the flame, a long camera was constructed, having its lens and ground glass plate at a fixed distance from each other. The ground glass plate was graduated empirically to read directly in millimeters the height of objects focussed upon it. The candle was placed on a pan attached to a spiral spring of such a length that its elongation would be just equal to the length of the candle. By this arrangement the top of the candle was kept at a constant height above the floor, and when once the image of the base of the flame had been accurately adjusted on one of the lines of the camera a screen (to facilitate which the screen was capable of a slight vertical movement), it remained there during a considerable period of time. Hence, to measure the height of a flame at any instant, it was necessary only to glance at the image of the top of the flame, and to note its position on the screen. It will be noticed that this camera device is, to a certain extent, a modification of Krüss' optical flame measure which has been in use a number of years. Extended to take in the bottom of the flame, and combined with the spring balance, it enables measurements to be made with great quickness and with a sufficient degree of accuracy by an observer who is located so far from the flame as to leave it entirely undisturbed by his movements. The magnifying power employed was about two, and heights were measured only to 0.5 mm. Greater closeness of measurement was deemed unnecessary on account of the ill-defined nature of the base and tip of the flame. The actual base of a candle flame is difficult to observe on account of the small quantity of light which it emits. The procedure adopted was to set on the line of demarkation between the charred and uncharred portions of the wick, since this was found usually to mark the base of the flame. In case a close inspection of the candle showed the base of the flame to be slightly above this point, a further adjustment of the screen was made. In order to insure great steadiness of the flame the candle was placed in a roomy, well ventilated box having a glass window. Having put the candle in position before the bolometer, and having adjusted the camera properly, the bolometer screen was raised and simultaneous observations were

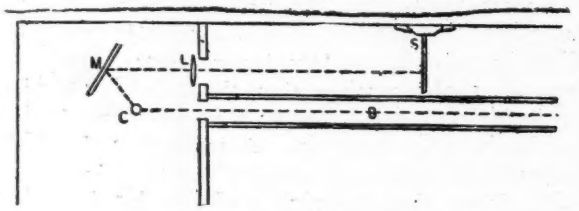


Fig. 2.—Arrangement of Photometer.

made of galvanomer deflections and flame heights. These readings were corrected for any change in sensitiveness of the bolometer and any drift of the galvanometer needle, and were plotted, using flame heights and galvanometer deflections as co-ordinates.

In the second method a Lummer-Brodhun photometer was used. At one end of a photometer bar 200 inches long was placed a 110-volt glow lamp. This was maintained at a voltage of 100 by means of a storage battery. Being run at low efficiency, its color was about the same as that of a candle, and its change in candle power during the time it was in use was too small to be detected. At the other end of the bar was the candle, supported by its adjusted spring. The candle was always placed so that the curl of the wick was perpendicular to the axis of the bar.

The arrangement for measuring flame heights is shown in Fig. 2, which represents a projection of the apparatus on a horizontal plane. *B* is the photometer bar, *C* the candle, *M* a mirror placed behind the candle in such a way as to reflect the rays from it through the lens *L*, which projected them on a graduated screen *S*, placed immediately behind the bar. The mirror was carried on a movable support so as to admit of an adjustment of focus. This arrangement was adopted, since by its use one observer could do all the work. The method was simply to make a rather quick photometer setting, and then instantly to note the position of the top of the flame on the screen, reading the position of the photometer afterwards.

In some of the earlier measurements a kerosene lamp with an Argand burner, similar to the ordinary student lamp burner, was used as a secondary standard. The upper part of the chimney was covered by a closely fitting cylinder of ferrotype iron in such a way that the top of the flame was entirely hidden. This furnished a very steady source of light after it had been burning long enough for the parts to become thoroughly warmed, and its intensity was unaffected by slight adjustments of the height of the flame, provided only that the flame was always high enough. Unfortunately its intensity varied enough from day to day to make its indications unreliable without a daily calibration, and it was replaced by the more convenient and accurate glow lamp. Observations of variation of intensity with flame height are not affected by this fact.

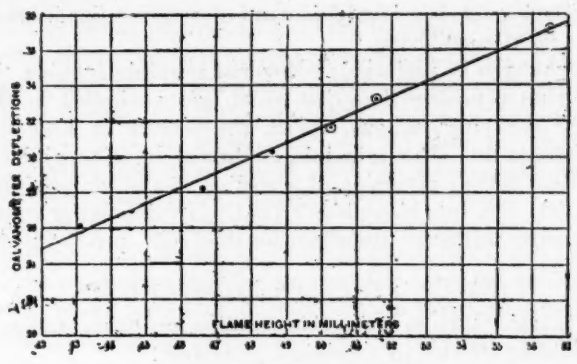


Fig. 3.—Bolometer Curve.

The observations were treated in the following manner: The various observed values of flame height were collected in such a way that heights of 41 mm., 41.5 mm. and 42 mm. formed one group; 42.5 mm., 43 mm. and 43.5 mm. another, etc. The mean height of each group was found, also the mean bar reading corresponding to it. The candle power of the standard was found by taking the mean of all the heights and bar readings, and reducing, by means of an approximate correction, to a standard flame height of 45 mm. Using this value for the intensity of the glow lamp, the intensity of the candle corresponding to each group was computed. By means of a curve plotted from these values the percentage variation per millimeter of flame height was determined.

In order to find the relative accuracy of this and of the ordinary method of using candles, the following observations were made: A candle burning normally was weighed by the "method of transits," was transferred to the spring balance, and ten or more photometer settings made, the flame heights also being noted. The candle was then weighed again and another group taken. A number of such sets of observations were made on several days, and since the glow lamp was used as a reference standard these sets are comparable with each other. The mean value of the candle power of the glow lamp given by each of these sets of observations was corrected for rate in the ordinary way, and was also corrected by reducing from the mean flame height to the standard height of 45 mm., using the mean value of the relation between intensity and flame height as determined from all the observations, both bolometric and photometric. The deviation of each value obtained for the candle power of the glow lamp from the mean value obtained from all the observations was computed, and this deviation was reduced to per cent. A comparison of the percentage deviations given by the two methods shows their relative accuracy, while the absolute values of the percentages show the error which one is liable to make in using candles in either of the two ways.

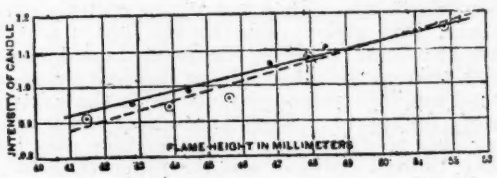


Fig. 4.—Photometer Curves.

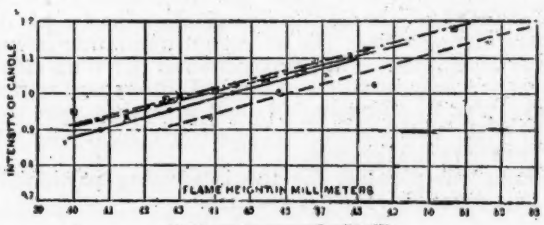


Fig. 5.—Photometer Curve.

The results obtained in the various sets of observations are shown in the following table: Figs. 3 and 6 show results obtained with the bolometer, connecting the height of the candle flame with the intensity of the radiation as measured by the galvanometer. Figs. 4 and 5 show

Bolometric.	Per Cent.	Photometric.	Per Cent.	Photometric.	Per Cent.
1894.		1895.		1895.	
Nov. 29	2.2	July 27	3.3	Dec. 3, E	
Dec. 5	2.7	Oct. 30	3.4	" F	
1895.		Nov. 1, I	3.3	" G	... ... 2.3
Feb. 23, I	2.2	" II	3.3	" H	
" II	2.5	Nov. 6, I	2.2	Dec. 4, I	
" III	3.2	" II	2.7	" J	
March 21.... I	3.1	Nov. 27, I	2.7	" K	
" II		" II	2.9	" L	..... 2.6
Oct. 4	2.7	Dec. 2, A.M., A	2.7	" M	
		" B		" N	
		Dec. 2, P.M., C	2.8		
		" D			
		" D			

similar results, the photometer, however, being used instead of the bolometer to test the radiation. The variation found in the intensity, expressed in the per cent. per millimeter, is shown in the table. An inspection of the table and curves will show that while the relation between flame height and intensity is a fairly definite one for any given

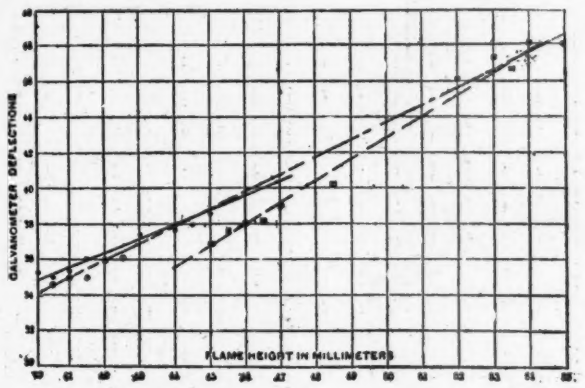


Fig. 6.—Bolometer Curve.

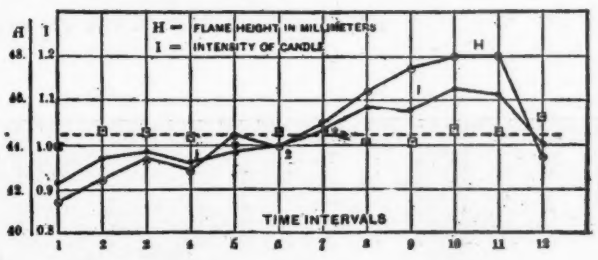


Fig. 7.—Variation of Flame Height (*H*) and Intensity (*I*) of English Candles. Dotted line shows intensity reduced to standard flame height.

group of observations, there is a considerable range of variation in the values for it as obtained from different groups. Moreover, the relation sometimes changes during one burning of the candle. Fig. 6 illustrates this peculiarity in that there is a group of points marked [▫] which lie considerably below the line plotted to represent all the observations; and that the slope of the flame height intensity curve plotted from the points marked [▫] is materially different from that obtained from other groups of points. This may be due to a change in the shape of the wick. The fact that this relation is not absolutely constant does not vitiate the proposed method of treating candle observations; for since the deviations of flame height from 45 mm. is seldom more than 10 per cent., if our assumed value for this relation is in error by as much as 20 per cent., our reduced value for candle power would be in error by no more than 2 per cent.

The mean deviation from the mean of observations corrected in this way was a little over 2 per cent., and 14 out of 20 values were in error by 2.1 per cent. or less. In the case of corrections for rate, the mean deviation was over 6 per cent., while but 1 out of 14 values deviated by less than 2 per cent., and only 4 by less than 4 per cent. In other words, by correcting for flame height an error of less than 2 per cent. may reasonably be expected, and the probability of making an error greater than 4 per cent. is small; while in correcting for rate, errors of 8 per cent. and 9 per cent. are of common occurrence. The values corrected for rate might, perhaps, be more consistent if the rule were followed to reject all observations in which the rate fell below 114 or above 126 grains per hour. Similarly, the errors in the values corrected for flame height might be smaller if observations made at extreme flame heights were to be rejected. Indeed, it is one of the chief advantages of the method that the observed flame height furnishes a criterion for the rejection of any observation which is regarded as doubtful. In this discussion, however, in order to be equally fair to both methods, no observations have been rejected.

The results of these photometer observations confirm fully those obtained by the use of the bolometer in determining the variations of light standards, and show very conclusively that the fundamental assumptions on which the bolometric tests were based were entirely justifiable.

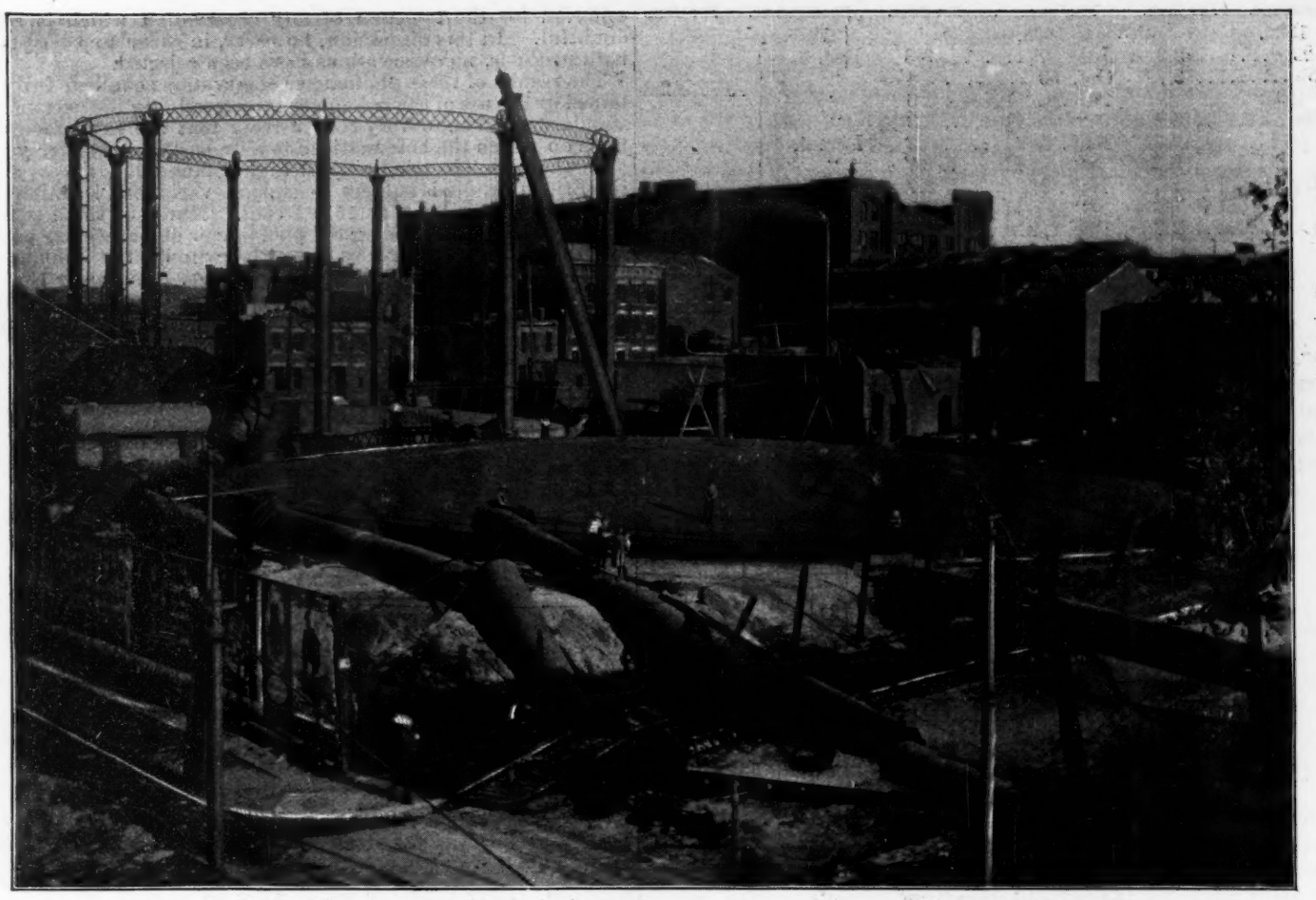
In the "Bolometric Study of Light Standards" it was shown that the British candle is subject to sudden variations in intensity, which are sometimes as large as 15 per cent. Many of these sudden drops were noticed while making the photometer observations, and they all had the same characteristics as are shown by the bolometer curves. Fig. 7 shows a group of these observations. Assuming that the time intervals between the various photometer settings were equal, points were plotted showing the relation between intensity of the candle and time and between flame height and time. It will be seen at once that the two curves are of very similar character. The flame height gradually increased, and with it the intensity, until, when the height of 48 mm. had been reached, there was a sudden drop, the change in intensity amounting to 12 per cent. These curves evidently show, in an imperfect way, variations precisely similar to those which are so faithfully reproduced by the galvanometer needle. In view of these qualitative and quantitative results, it would seem to be impossible to doubt the reliability of the bolometer as an instrument for making such tests.

The Utilization of Powdered Coal.

Some years ago Herr Carl Wegener, a German engineer, brought out a new process for utilizing powdered coal. It is based on the principle that coal cannot be thoroughly burnt unless each particle is surrounded with sufficient oxygen to ensure perfect combustion, and this can only be effected by first reducing the coal to powder. According to Kuhlow analyses of the gases of combustion prove that there is much more perfect combustion with the new method of firing with powdered coal than with large coal. The previous invention of Herr Wegener was tested about two years ago at the Nord-Deutsche Lloyds Works at Bremen, and very successful results were, it is said, obtained. Herr Wegener set to work to simplify his invention, and has now produced an apparatus in which the chimney draught alone supplies the required current to admit the powdered coal mixed with the required quantity of air into the firebox. The advantages claimed for the invention are: An economy of coal of at least 20 per cent., and saving of labor as the powdered coal is fed automatically; one man can easily attend to four or five boilers, and as there are no doors to open he is exposed to little heat; combustion is practically perfect, and each particle of coal is reduced to a white incandescent heat, there is no smoke from the chimney and no fire bars, door or grate. The following is a brief description of the system: The small sacks of powdered coal weighing about half a hundredweight are put into a conical hopper; the powdered coal gradually falls out of the sack, as required, into the hopper, and then on a sieve about 5½ inches in diameter, with small openings in it. The powdered coal would not go through this sieve, with certainty, without continued tapping, and this is done in the following manner: Immediately beneath the hopper, and level with the boiler-house floor, is an air-pipe about 20 inches in diameter, through which nearly all the air for combustion enters. As it enters it is made to pass through the blades of an air wheel or turbine, and this passage of the air causes the latter to revolve like a smoke-jack. On the axis of the air-wheel there is a little knocker, which taps the sieve about 150 or 250 times per minute, causing the powdered coal to descend vertically through the sieve, meeting the air for combustion as it falls. The powdered coal and air for proper combustion in this way get mixed thoroughly together, and pass on into the boiler flue, each particle of coal being surrounded by air. There is no grate, and there are no fire doors, and the stoking simply consists of putting a sack of powdered coal from time to time into the top of the hopper, and seeing that the right amount of air is going in for combustion. If there is not sufficient air for proper combustion entering through the main opening, as seen by a little smoke, there are two other smaller pipes, where additional air can be admitted, each kind of coal requiring a somewhat different amount of air. The only object of the air-wheel revolving, from 50 to 80 revolutions per minute, is to shake the sieve and cause the powdered fuel to go into the furnace in the quantity desired. When more steam and coal are required a sharper knock is given to the sieve, and more powdered coal is burnt; when less is required a slighter shake is necessary. A screw adjustment for knocking is provided to regulate the amount of coal entering, which is done by turning a half-inch thumb-screw. The only duty of the attendant is to put the sacks of coal into the hopper, and he ascends a short ladder to do this. He also has to regulate the amount of air for combustion, and then there is no smoke.

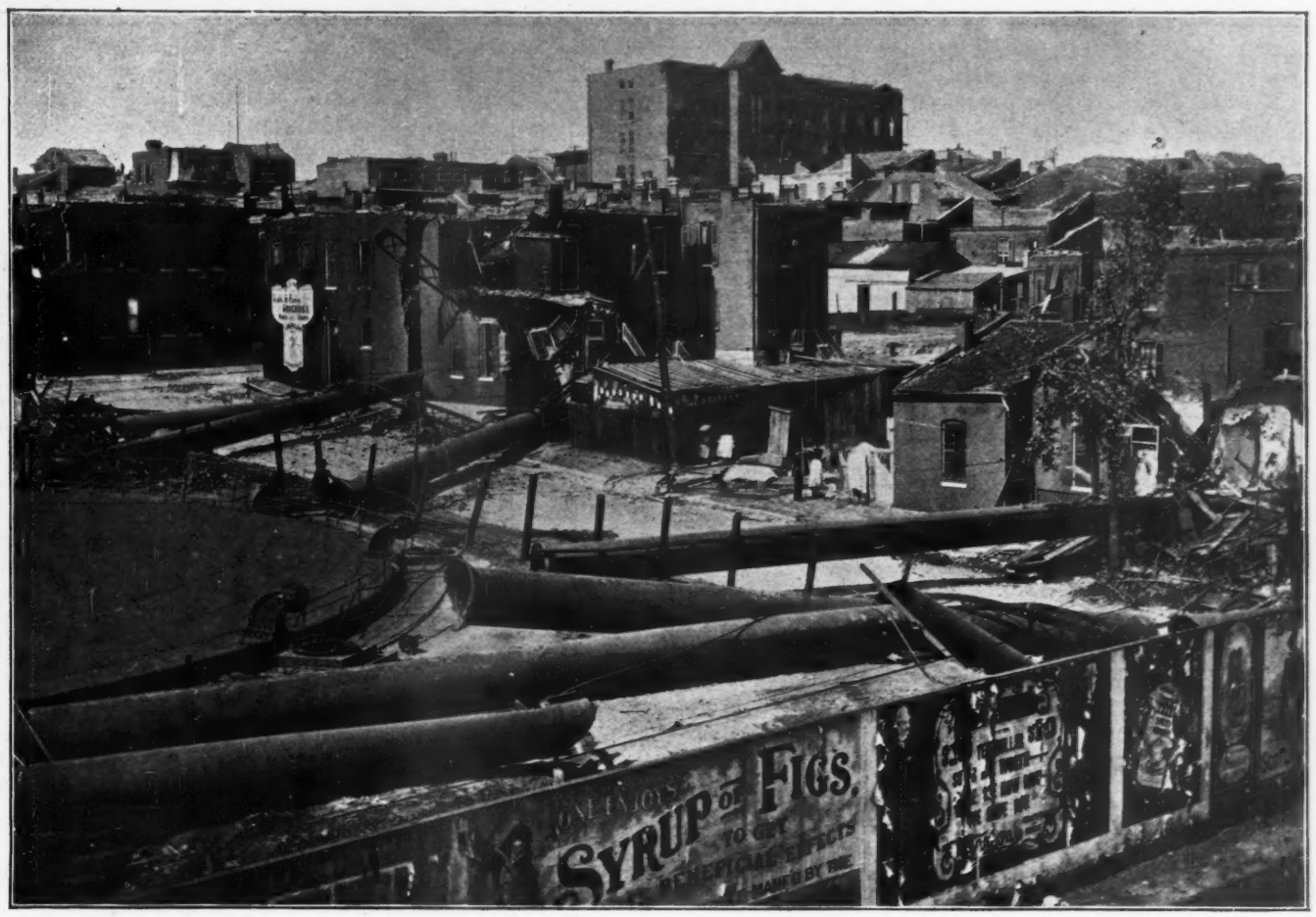
Reminders of the St. Louis, Mo., Cyclone.

Conformably to our promise of a fortnight ago we give the following illustrations of the partial wreck of Station C, of the Laclede Gas Light Company's works, which overturning was caused by the severe storm that visited that section, May 27th, 1896—the series here given have reference particularly to the damage done to the holders.



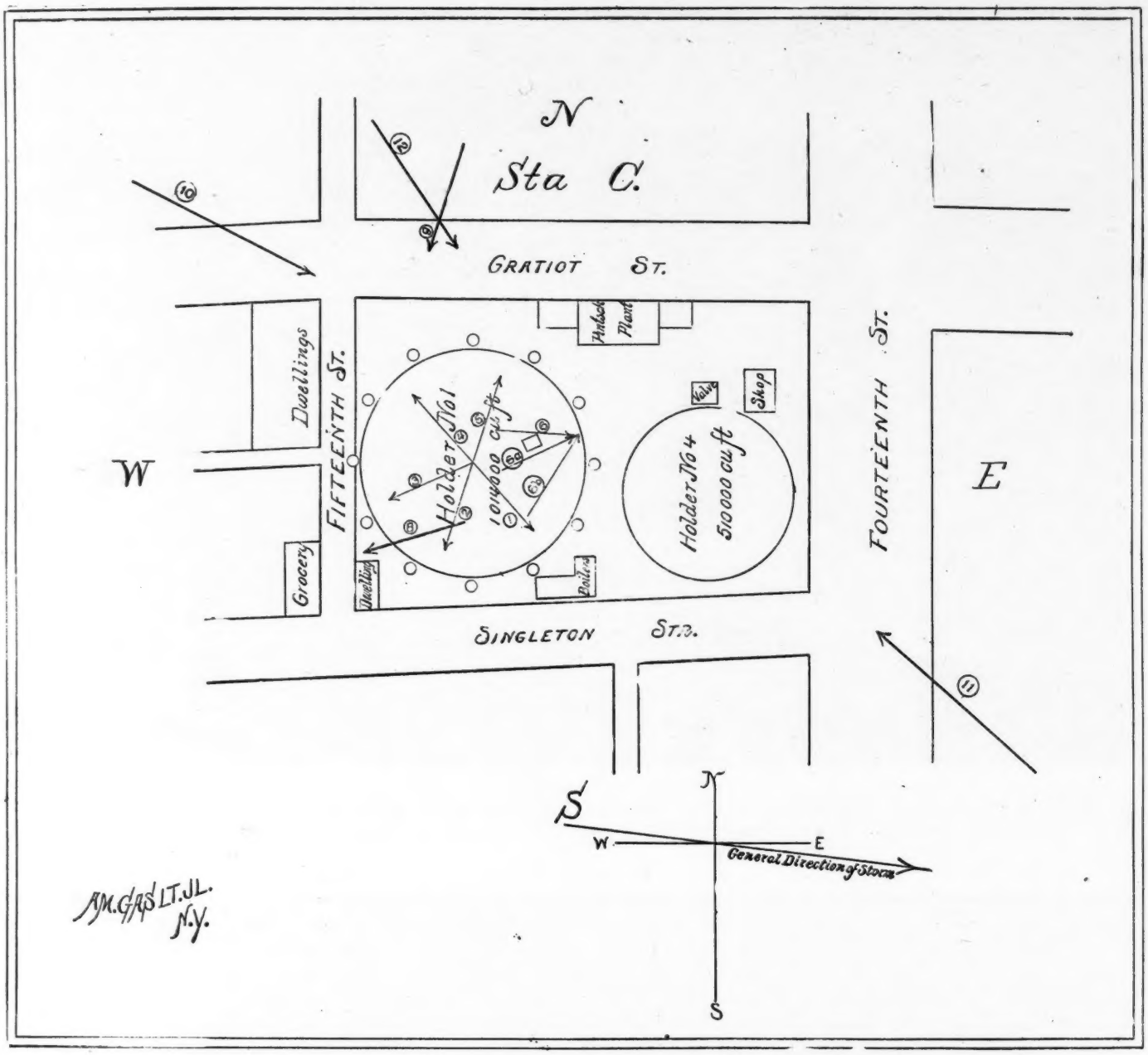
View from Gratiot street, west of 15th, looking southeast. One column of the 12 was lifted several feet from its base and fell eastwardly against the top of one of the columns of the holder adjoining. This holder was only about 15 feet up, while the wrecked one was nearly full (about 65 feet high).

View from across Gratiot street, looking northwest. The people standing near the crown of the small holder indicate the spot where a fence, a telegraph pole and part of the roof of a building across the street went through the side of the holder. The frame of this holder was strained so that some of the columns were six inches out of the vertical. In the distance at the right is seen the rear end of the Union Railway Station.



View from across Gratiot street, looking a little west of south. The columns are all plainly seen pointing to the west. The columns were all broken off close to the base plates. One of the girders can be seen in the wrecked building on the right.

View at 15th and Gratiot streets, from near the middle of the crown of the wrecked holder, looking a little south of west. It will be noticed that the columns and girders were carried in a direction opposite to that of the storm. A girder weighing nearly a ton and a half was projected through the roof of a building, across 15th street.



Plat Showing Line of View of Station C. Laclede Gas Works, St. Louis, Mo.

Technical Education in Japan.

Engineering remarks that the recent great development in almost every department of industry in Japan, and its effect on British trade in the Far East, has come as a revelation to the majority of people in this part of the world, but to those acquainted with the actual facts there has been no surprise. For a quarter of a century the Japanese have been steadily laying the foundations of future industrial and commercial greatness by attention to the educational wants of the people, and in some respects their system of elementary, secondary, technical and university education is more complete than that which exists in this country. Some time ago Lord Reay, formerly Governor of Bombay, and for a long time a keen educationist, in speaking on behalf of a deputation to the Secretary for Scotland, said that if things progressed in Japan as they were doing, it would be necessary to send a Commission to that country for the purpose of obtaining a few lessons for the improvement of our educational arrangements. No doubt many of those who read this remark thought that it was of the nature of a joke, but his lordship seriously meant what he said, and, moreover, was justified in his words.

From the last published returns of the Institution of Engineers in Japan, we find that it has a total of 1,564 members, of whom 399 are full members, 1,121 associates, 11 honorary and 33 corresponding members, and as these men are almost all actively engaged in engineering and industrial work of all kinds, we see that the educational institutions have borne good results. We can easily understand why, under these circumstances, the Japanese are able to dispense with the services of foreigners to the extent which they do, and why Japan offers so few opportunities to engineers and others who go there on the chance of finding suitable employment. There is probably no country in the world where there is such a good supply of men for the opportunities which offer, and who, on the whole, are fairly well qualified to undertake the work which they profess to be able to do. It must, however, be remembered that the field is still very limited, and that it only admits of gradual extension. In a recent report by the Secretary of the British Legation at Tokio, he mentioned that, notwithstanding the great extension of the railway system during the past few years, at the time he wrote there were only six foreigners in the service of the Japanese government railways, and these were only utilized for exceptional work and for purposes of consultation, and were no longer employed in the management or construction of lines, which rest entirely in Japanese hands. We believe that since this report was written the number has been still further reduced. When new industries are introduced no doubt a number of foreign experts will be engaged, but we may rest assured that their term of service will be limited, and that every effort will be made to train Japanese to take their places. It is well that this should be distinctly recognized in this country, so that no false hopes may be built up.

It is curious to observe the small beginnings of some movements which have most important results on a country, and it may be in some respects on the world. The industrial development of Japan had its origin in the escape of a few young men from that country to Britain, when all foreign intercourse was forbidden. Some of them studied engineering, and they, to a large extent, have been the guiding spirits in

the great developments which have taken place during the past quarter of a century. After the overthrow of the Shogun (generally called Tycoon in this country), which placed the Mikado at the head of the actual government, the first work of a national character undertaken under the new *régime* was the construction of a very complete system of lighthouses. A little later on, when railways were started, a system of practical education in engineering was arranged, and each foreign engineer had under his charge a few cadets who were supposed to be instructed both in the theory and practice of their work, while several elementary schools were instituted for the purpose of giving some of the necessary preliminary training. No doubt some of the men brought up under these conditions have turned out very well, but the arrangements were soon seen to be of a very imperfect nature, and that something more complete was necessary. Accordingly the Embassy which visited this country in 1872 were instructed to engage a staff for an engineering college. The principal appointed was Dr. Henry Dyer, now of Glasgow, and convener of the Teaching and Staff Committee of the Glasgow and West of Scotland Technical College, and among the professors were Professor W. E. Ayrton, now of the Central Institution of the City and Guilds of London Institute; Dr. Edward Divers, who is still in Japan; Professor D. H. Marshall, now of Kingston University, Canada; and Professor E. F. Mondy, now in one of the government colleges in India. As the work developed, others who have since become well known were engaged, and among these may be mentioned Professors John Perry, John Milne, Josiah Conder, Thomas Alexander and A. W. Thomson.

The course of training in the college was very complete, and extended over six years. The first two were spent entirely at college. During the next two years six months of each year were spent at college, and six months in the practice of the particular branch selected by the student. By this alternation of theory and practice, the students were able during each working half-year to make practical application of the principles acquired in the previous half-year. The last two years of the course were spent wholly in practical work in one of the establishments belonging to the Public Works Department. Arrangements were made for giving very complete courses of instruction in (1) civil engineering, (2) mechanical engineering, (3) telegraphy, (4) architecture, (5) practical chemistry and metallurgy, (6) mining. When the first set of students graduated, 12 of them were sent to Britain, and without exception they took very high places in the university and other classes which they attended, thus showing that they had profited by the instruction which they had received in their own country. At the same time, the principal drafted a set of rules for an Institution of Engineers, and this has now developed to the extent already mentioned, its members being the most powerful factors in the industrial evolution which has since been going on. Its leading officials are still for the most part past students of the first few years of the Engineering College.

That college, however, was not the only institution in the country in which instruction was given in engineering. The Imperial College of Engineering (Kobu-dai-gukko) was connected with the Department of Public Works, and was primarily intended to supply officers for that department. A year or two after its foundation, Professor R. H. Smith, now of Mason's College, Birmingham, was appointed Professor of Engineering in the University of Tokio, which was in the Department of Education. On his retirement from that position he was succeeded by Professor Ewing, now of Cambridge. The students of the university labored under the disadvantage of not having the same opportunities for practical work as those of the Engineering College, although some of them obtained that later on, and have since performed very good service.

In the course of time various changes took place in the staff of the Engineering College and in its constitution, into the details of which, however, we need not enter. In 1885 the Public Works Department was abolished, its functions being merged in other departments, an event which caused the college to be transferred to the Department of Education. On March 1, 1886, an Imperial Ordinance was promulgated for reorganizing the University, and the Engineering College was merged in the new institution. The university has now colleges of law, medicine, engineering, literature, science and agriculture. The course of study in each extends over three years, excepting the course in medicine, which extends over four years. In the Engineering College there are now courses of instruction in (1) civil engineering, (2) mechanical engineering, (3) naval architecture, (4) technology of arms, (5) electrical engineering, (6) architecture, (7) applied chemistry, (8) technology of explosives, (9) mining and metallurgy. The college has several very complete laboratories and workshops. In those connected with mechanical engineering the students get their first ideas of machine tools and practical work. They are supplied with various kinds of steam, gas and hot air engines, arranged for purposes of experiment, while there is an ample supply of machine tools and testing machines of all kinds. In the laboratory of mining and metallurgy special arrangements have been made for assaying and ore dressing, and there is a plentiful supply of mining and metallurgical appliances. The laboratories for electrical engineering and applied chemistry are fitted with all the most recent appliances, and every facility is afforded for very complete instruction. Each department has attached to it a museum, where the specimens, models, instruments, etc., necessary for the different courses of study are arranged in order, and are available for purposes of illustration, experiment and practical work. There are not, however, the same complete arrangements for practical training as existed when the Engineering College was first instituted; a large part of the engineering and industrial undertakings has passed into the hands of private firms or large companies, and the students must, as in this country, obtain their practical experience as best they can. The result has been, that while the students are well up in theory, they have little idea of its application to practice, and do not seem to take to it with the same spirit and enthusiasm as those who, in the earlier part of their career, had a combined course of theory and practice. Probably the altered conditions of the country made the change of arrangements necessary, but those who are best able to judge do not think it an improvement.

In addition to the Engineering College, there is the College of Science, in which there are complete courses of instruction in (1) mathematics, (2) astronomy, (3) physics, (4) chemistry, (5) zoology, (6) botany, (7) geology, and in each of them arrangements are made for the study of the highest parts of the subjects. The memoirs which have been published by the college show that the results of the instruction are of a most satisfactory nature, and compare favorably with those of any other similar institution in the world. The only other college in which we are specially interested is that of agriculture, in which there are courses in (1) agriculture, (2) agricultural chemistry, (3) forestry, (4) veterinary medicine; and the complete arrangements which have been made show that while the Japanese are anxious to develop new industries, they also wish to improve the oldest and what is, after all, the most important industry of all, namely, agriculture.

It would occupy too much of our space if we attempted to enter into a description of all the subsidiary arrangements connected with the university, but taken altogether we have no hesitation in saying that Japanese university students have as good opportunities as those of any other country. We may have a few Japanese students for special subjects in colleges and universities in this country, but none who have gone through a systematic course at home will find it necessary to repeat the routine of the ordinary student. The total number of students on the roll of the University of Tokio, as given in the last edition of the calendar, is 1,468, while the graduates now number 2,249. Such a body of men must have a powerful influence in moulding public opinion and in advancing the material and intellectual welfare of the country.

While attention has been paid to the higher departments of education and to the requirements of those who are able to take advantage of them, the wants of the great body of the people have not been overlooked. Good elementary schools have been instituted in all parts of the country, and secondary schools in the most important towns, and a number of normal schools have been established for the training of teachers. We only mention these, however, for the purpose of indicating the completeness of the system, as their full description would require much space. There is, moreover, a number of special schools of a lower grade than the university; these are intended to afford a training to those who will take charge of the more practical arrangements, and who do not aim at a university career. Great attention has been paid to commercial education, and schools of two classes have been started. Those in the first class are designed chiefly to train intelligent traders, while those in the second are designed to train persons in the management of commercial affairs generally. Their courses of study are very similar to those of the commercial schools which have produced such good results in some countries in Europe.

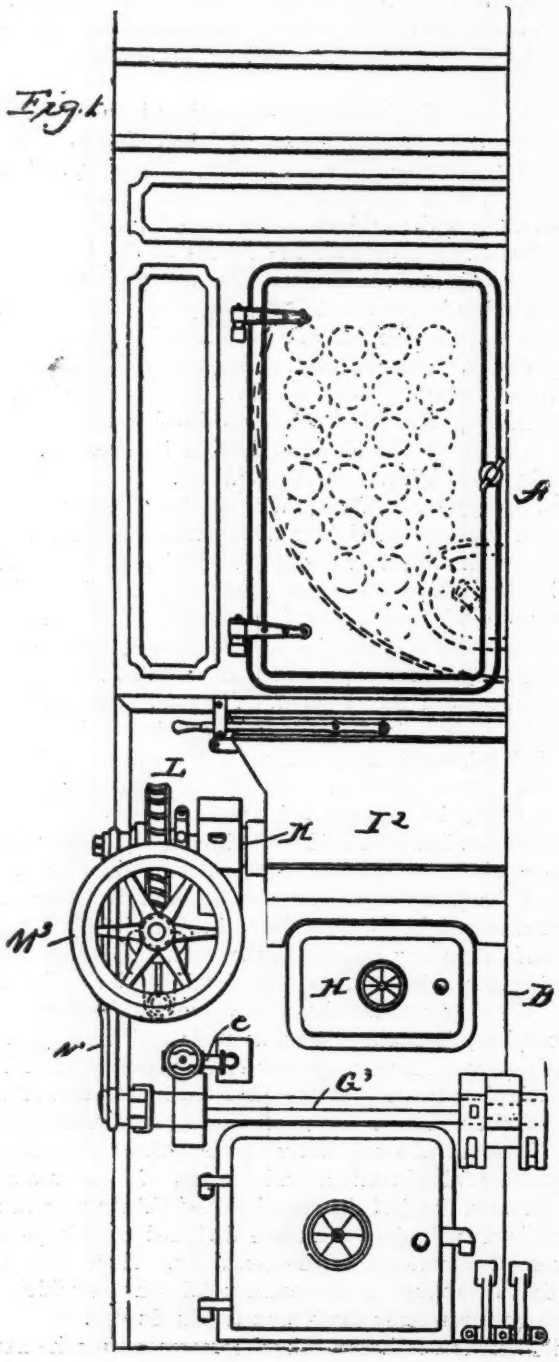
In Tokio there is a technical school somewhat after the nature of the trade schools on the Continent, the object of which is to prepare persons as instructors in industrial schools or as foremen or directors of manufactories. It has courses of study extending over four years in the departments of chemical, mechanical and electrical technology, and judging from the lists of subjects in its programme, it appears to embrace under these heads almost every department of industry. A special department is called the Apprentices' School, and is intended to give instruction in such subjects as are appropriate for the sons of men en-

gaged in wood and metal works. In various parts of the country there are special schools of different kinds, but these seem to be designed chiefly for the purpose of improving the native arts.

The outline sketch which we have given of the progress and present conditions of technical education in Japan is sufficient to show that the Japanese are not by any means the superficial people which many take them to be. Their progress in modern industry has been rapid, and it has not been simply the result of a run of good luck, but has been brought about by following out a clear and consistent programme, of which a most important part has been the education which is necessary as a basis for modern trade and industry.

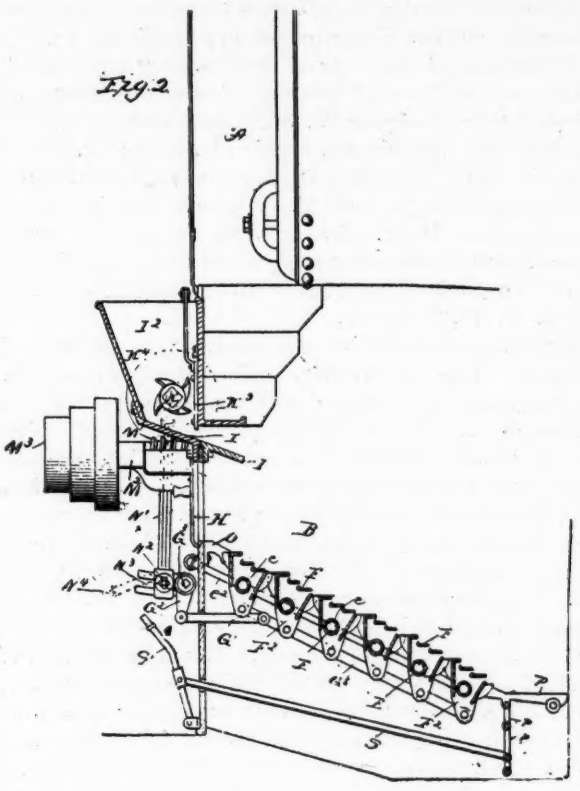
The Marshbank Mechanical Stoker.

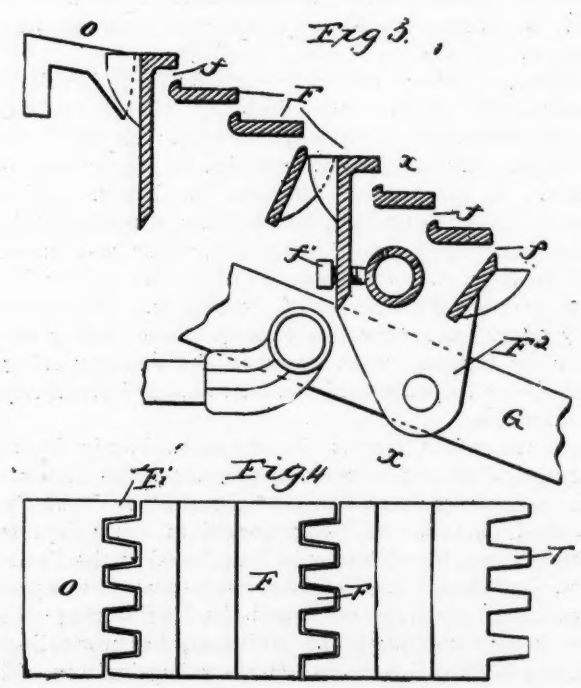
A device for the regulation and the automatic feeding of fuel, adaptable also to hand firing, should this be desired or necessary, has been patented by Andrew J. Marshbank, of Lansdale, Pa., and the patent has been acquired by David Fleming and Martin E. Hershey, of the Harrisburg Foundry and Machine Works, Harrisburg, Pa. The illustrations indicate the construction and operation of the device, Fig. 1 being a front elevation of one-half a furnace equipped with the stoker, Fig. 2 a vertical sectional elevation, Fig. 3 an enlarged detail section of the grate, and Fig. 4 a top plan of it.



In the firebox *B*, inclining downward from front to rear, are bearing bars, those at the sides being hollow, and that at the center being solid, but having a deep bottom web to insure strength, and all being provided with suitable bearings *c* for the ends of tubular grate bar shafts *E*. The latter have openings *e* along their upper portions for the exit of steam or steam charged air forced in by steam jet nozzles e^1, located in the side bearing bars, directed into the ends of the grate bar shafts and supplied with steam through pipes e^2, Fig. 2 leading from the boiler or other source of steam supply.

Upon each grate bar shaft is mounted a grate bar having its upper surface in the form of a series of relatively narrow steps *F*, with slot openings *f* in the risers for the admission of air to the fire bed. The grate bars are located at different levels, forming an inclined fire bed, and along each edge of the bars there is formed a series of teeth or projections F^1, which intermesh with the teeth or projections on the adjacent bars, as shown in Fig. 4. Thus, while any fine ashes may work through as the grate bars are rocked back and forth, no fuel can pass through. The bars are secured to their respective shafts by set screws f^2, and it will be noted that the shafts discharge up within the grate bars, thus not only insuring a full supply of air for combustion, but at the same time keeping the bars from burning out or warping.





The rocker bar *G* is connected to a downward extension F^2 of each grate bar and at the forward end it is provided with a connecting rod

G^1, extending through the front of the ashpit and connected to a crank arm G^2 on a shaker shaft G^3.

Above the upper end of the grate is an opening for hand firing, normally closed, however, by a door H, and above this door is a second opening through which the fuel is automatically fed by the stoker. On the inside and at the bottom of this opening there is bolted an apron or feed plate I, an outward prolongation of which, formed by the plate I^1, constitutes the bottom of the supply hopper I^2, into which the fuel is dumped and from which it is fed by the feed-roll down the inclined feed-plate I on to the upper end of the grate.

The feed-roll is formed by a square shaft K, carrying a series of hubs k, each provided with wings k^1 constituting the supports for the feed-roll blades K^2, bolted thereto. They are slightly curved in cross section, and rotate immediately in front of the feed-opening, operating to draw fuel down and force it through the opening. The size of the opening may be adjusted by means of the sliding gate K^3. On one end of the shaft K, outside of the hopper, is a worm gear wheel L, connected with the shaft through a clutch L^1, having a shifting lever or other means for controlling it. A worm M is in mesh with the worm gear L, and the power for driving the worm is transmitted from any suitable source through one or the other of the cones of pulley M^3 on the shaft M^1. The worm gear wheel L is also adapted to drive the shaker-shaft. By adjusting the pin N^2 in the slot bearings the amplitude of movement imparted to the shaker-shaft and consequent extent of movement of the grate bars may be varied at will, and by disconnecting the connecting rod N^1 entirely the shaker-shaft may be operated by a hand lever N^4, in dotted lines, shown in Fig. 2.

Fuel is prevented from escaping into the ashpit at the top of the grate by a stationary grate section O, secured to the front wall of the firebox and having a toothed front edge into which the teeth on the top grate bar fit (Figs. 3 and 4), and at the bottom of the grate the ashes, etc., are received on a horizontal dumping grate P, pivoted at the rear end and supported at the forward end on toggle links p p, to one of which the dumping rod S is attached and extended out to the front of the ashpit, where it is connected with the operating lever S^1. By the employment of toggle links the three pivotal centers of the links may be brought into alignment to support the dumping grate in horizontal position, and at the same time leverage is secured for moving it.

In operation the fuel is dumped into the hopper and the pulleys M^3 bolted to any suitable source of power. The rotation of the pulleys through the worm-gear connections rotates the feed roll, giving a constant and even supply of fuel over the feed or dead plate down on to the upper portion of the grate. The rate of feed is governed by the speed at which the pulleys M^3 are driven. Simultaneous with the feeding of the fuel the grate sections are oscillated by means of the connecting rod and cranks, and should it be desirable at any time to operate the latter mechanism without operating the feed-roll it may be done by throwing the clutch L^1 out of engagement, disconnecting the shaft K from its drive wheel. Fuel may then be supplied by hand through the opening immediately above the gate.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE regular quarterly dividend of 2 per cent. on the capital stock of the Municipal Gas Company, of Albany, N. Y., has been declared. It was payable on the 1st inst.

MR. T. A. BATES has been engaged to oversee the remodeling of the plant of the Natchez (Miss.) Gas Light Company. As we understand it, the Company proposes to virtually reconstruct its purifying plant—an improvement that should have been made by it years ago.

AT a recent meeting of the Salina (Kas.) City Council, a special committee, in conjunction with the committee on corporations and franchises, made a report recommending the terms of a contract to be entered into between the city and the new electric light company. The report recommended that the city should pay $90 per light for 28 lights; that the contract should be made for three years; and that it should be upon the condition that the company should expend money for material and labor to the amount of $17,000. Mr. N. A. Hook, of Leavenworth, Kansas, President of the Company, who was present at the meeting, in addressing the Council said it would be impossible to carry out the contract if the price were cut to $90, asserting that the price of fuel for steam raising in Salina was such that $100 per light (of course, the lighting is to be carried out on a moontable) was the least sum that could be considered. He spoke in detail about the project, and his arguments and figures were so well put that, in the end, a motion to raise the rate to $100 per lamp was adopted.

ADVICES from Cincinnati, under date of the 25th July, are to the effect that Judge Hollister has allowed the peremptory writ of mandamus in the case of the State, on the relation of Judge Outcalt, acting for the Cincinnati Gas Light and Coke Company, against Mr. John Hagerty, Auditor. The case was a suit in mandamus to require the Auditor to issue his warrant for a refunder for the first half of the taxes for 1895, and a remitter for the last half of the taxes for 1895 to the relator, and for him to advise the County Commissioners that, in the years 1891, 1892, 1893 and 1894, overpayment had been made by the reciter in its taxes. The amount of money involved is approximately $12,000.

THE proprietors of the Sintz Gas Engine Company have commenced work on their new factory buildings at Grand Rapids, Mich.

WE are informed there is little likelihood that the proposed opposition Gas Company for Topeka, Kansas, a franchise for which was granted quite a while ago to Mr. J. R. McIlvreid and his associates, will get beyond the organization stage.

THE Bank of Cedarville, Ohio, recently filed suit in the United States Circuit Court for Kentucky, for a receiver for the properties of the Mount Sterling (Ky.) Gas and Electric Light Company. On the conclusion of the hearing, the Court acceded to the petition, and named Mr. G. W. Baird, of Mount Sterling, as the receiver. The proceedings were based on the failure of the Company to retire certain past due mortgages.

MESSRS. Henry A. Parr, Samuel H. Buck, Nicholas P. Bond, Arthur F. Spice and Gabriel J. Rhein have incorporated the Gas Saving Company, of Baltimore, Md. The concern is capitalized in $20,000.

AT the annual meeting of the Municipal Gas Company, of Albany, N. Y., the following Directors were elected: Anthony N. Brady, Roswell P. Flower, Robert C. Pruyn, E. C. Benedict, William McEwan, John G. Myers and Horace G. Young. Subsequently the Directors perfected this organization: President, Anthony N. Brady; Vice-President, Robert C. Pruyn; Secretary and Treasurer, Henry Bronk.

THE Board of Assessment of San Francisco, Cal., and the last Grand Jury of that city, are much apart over the figures at which the properties of the named Companies should be assessed for purposes of local taxation. Here are the respective estimates:

Company.	Assessor's Views.	Grand Jury's Idea.
San Francisco Gas.....	$3.495,000	$3,750,000
Edison Light, etc.....	1,102,645	1,237,500
Pacific Gas Improvement. ..	1,106,670	1,246,187
Central Gas Light.	841,700	950,000

THE fourth semi-annual convention of the Northwestern Electrical Association was held at Marinette, Wis., on July 15, 16 and 17. Mr. W. B. Baker, of Waupaca, Wis., directed the proceedings with firmness and tact, and the convention was in all respects successful. The papers and discussions were bright and brisk, and the attendance was excellent. A noteworthy thing in connection with the meeting was the report of the committee appointed to consider President Baker's address, in point of certain recommendations it contained regarding the evils of municipal opposition and so on—in fact, we think the report is of sufficient interest to our readers to reproduce it in full. The committee said:

"Your committee find several points of great importance in the address of our President that we consider worthy of serious consideration; in fact, we consider them of more importance than any engineering point that might be brought up for your discussion and action. The points to be considered in the address are municipal and opposition ownership; the collection of statistics showing rates charged for services furnished by the central stations throughout the territory covered by this Association, and the relationship of insurance companies to central stations.

"The matter of rates is not in our jurisdiction, because we understand that the adoption of the Secretary's report covered this ground; but as some report may be expected of us on this point, we incorporate some suggestions in regard to this.

"We consider the matter of municipal and opposition ownership of vital importance to central stations through our territory, and recognize that the installation of municipal and opposition plants is a threatening and growing evil to our business as a whole.

"We deem this a matter that should be acted upon at once, and we would suggest that a committee of three be appointed by the Chair and give them something like the following instructions: To act for the Association, and prevent, by all honorable means, the establishment of any municipal and opposition plants; to gather facts and figures in regard to municipal lighting that will be of use to central stations that are threatened with municipal opposition; to confer with the manufacturers of electrical apparatus, and secure, if possible, their willingness to be guided by the wishes of this Association; to investigate every appeal that is made to them through any of the central stations, managers or owners in our territory, and, if satisfied that the local plant is ready to deal honestly, fairly and justly with the municipality or the citizens, to request that the manufacturers of electrical machinery shall not bid on the proposed plant.

"In regard to gathering statistics of rates charged by the various central stations within our district. We deem this a very important matter, and we recognize the advantages of a uniform rate throughout any territory, as the place with a high rate is unfavorably compared with that of the low rate, although there may be less profit in the high rates, due to the fact that the low rate has a more advantageous form of power, and helps support the fixed charges of the business through the profit of furnishing gas, water or street service in connection with the electric lighting work.

"That the Secretary will immediately proceed to gather statistics. We suggest that he use any means that appear most practical to him, and possibly he may find great assistance from the publications already made, and by the help the supply men are able to give him.

"The information gained should be explicit upon the conditions under which each and every plant is operated, especially as it relates to the power used, whether the plant has any other occupation, whether the lamps are furnished free, and renewals the same.

"That it shall be the duty of the Insurance Committee to meet a committee from the Board or Boards that fix the rules and rates in our district, and if this is not practicable, to communicate with them and point out in what way their rules, regulations and rates are unnecessarily severe, and to procure a modification of such rules, regulations and rates, if possible, and report from time to time, and not later than our next annual meeting.

HENRY L. DOHERTY,
R. F. KOUNTZ,
C. C. PAIGE, } Committee."

THE chairman of the committee (Mr. Henry L. Doherty) that presented the above report is the General Manager of the Madison (Wis.) Gas and Electric Company, and he is very much in earnest about the advancement of the best interests of artificial lighting supply.

THE California Automatic Lighting Company has notified its shareholders that any stock upon which the assessment ($1.40 per share) levied last June remains unpaid will be sold at public auction on the 16th inst. Payments should be made to the Secretary, W. S. Zeilin, at the office of the Company, No. 400 Sutter street, San Francisco.

ERNEST A. JAHN, proprietor of the Columbia Hall, Pratt street, Baltimore, Md., has brought suit in the Court of Common Pleas, against the Consolidated Gas Company, of Baltimore, in which he claims $10,000 damages because of his arrest last March on a charge of defrauding the Company by a scheme under which he used its gas without paying therefor. He was acquitted of the charge in the Criminal Court, March 31.

MR. DAVID LEAVITT HOUGH sailed for Europe on the 1st inst., per steamship Lucania. He will likely remain abroad until December 1st. His address will be care Messrs. Brown, Shipley & Co., London, England.

AT the annual meeting of the stockholders of the Salinas City (Cal.) Gas and Water Company, the following officers were elected: Directors, J. B. Iverson, C. W. Quilty, J. H. McDougall, Elisha Archer and William Vanderhurst; President, J. B. Iverson; Treasurer, William Vanderhurst; Secretary, H. J. Wilke.

THE Chattanooga *News* says that the city is still in debt to the Chattanooga Gas Light Company to the extent of $8,802.36, which indebtedness was brought about by the suit which the Company won against the city several years ago. The city had never paid any cash on the judgment, but the Company has been credited with taxes against it for four years. The entire indebtedness will probably be wiped out in that manner.

MR. GEORGE MANSFIELD, Superintendent of the Salem (Mass.) Gas Company, while standing on the Company's wharf, sustained painful injuries to his right foot, through the falling upon it of an iron ring, accidentally detached from a hoisting apparatus.

THE Columbus *Dispatch* says there is a prospect that the Columbus (O.) Gas Company will go into the courts for the purpose of ascertaining how much of its property can be taxed by the county. The Board of Equalization has an opinion from the City Law Director, Mr. Bargar, to the effect that the Company can be taxed for all the products from the coal which it carbonizes, which products include not only gas, but coke, tar and ammoniacal liquor. Heretofore the Company has paid taxes only on its manufacturing plant. We should and do think that the Board of Equalization will have a difficult task to establish the justness of its belief that the products named are subject to separate taxation, when the Company has been mulcted already in the shape of real and personal taxes. The Board might just as fairly seek to ask the petty farmers of Columbus to pay taxes on the potatoes, cabbages and other vegetables which they raise from ground upon which a real estate tax has been paid.

AT the annual meeting of the Duluth (Minn.) Gas and Water Company the following Directors were elected: O. C. Hartman, A. W. Hartman, William O. Lucas and Robert B. Dunn, of St. Paul, and W. L. Phelps, of Chicago. Mr. Dunn replaces Mr. William Craig, and Mr. Phelps replaces Mr. George C. Squires.

THE bids submitted in the competition for the public lighting of South Orange, N. J., were: Newark Gas Light Company, $19 per lamp per year; Welsbach Street Lighting Company, 175 or more 60-candle power lamps, $32 per lamp per year; Peoples Light and Power Company, 175 incandescent electric lamps (32-candle power each), $16 per lamp per year—on the basis of a 5-year contract; Globe Gas Light Company, naphtha lamps, at 6½ cents per lamp per night.

THE Albert Lea Gas Machine Manufacturing Company, to manufacture gas machines of the Swen type, has been incorporated. Its headquarters are in Albert Lea, Minn., and its officers are: President, John Wolhuter; Vice-President, G. H. Briggs; Secretary and Treasurer, C A. Briggs; Superintendent and General Manager, A. E. Ransom.

WE understand that the Framingham (Mass.) Electric Company has been purchased by Boston capitalists.

THE Reading (Pa.) *Eagle* says that the Consumers Gas Company, of that city, is testing all the meters in use. There are about 6,300 meters at work, and from them gas is supplied to 3,600 separate buildings.

THE system of street car propulsion by gas, devised by Mr. Thomas C. Pole, is to be tried on a good working scale on the Anacostia Railroad, Washington, D. C.

THE contract for the public lighting of San Francisco, Cal., has been awarded to the San Francisco Gas Light and Edison Light and Power Companies. Gas lamps are to be paid for at the rate of 12 cents per night; the arc service is to cost 55 cents per light per night.

THE improvements on the Holyoke (Mass.) works have been completed. The new water gas plant, which is of the Humphreys-Glasgow type, is giving unqualified satisfaction.

THE Quincy (Ills.) *Herald*, referring to the possibility of an opposition gas franchise for that city being granted, says: "It is said an outside syndicate is talking of starting a new Gas Company here. The present Company is made up of Quincy capital, and as it has always given excellent satisfaction it is entitled to patronage and support in preference to strangers. If another Company is to come in here and tear up the paved streets, it should pay well for it; and, before giving the right, the City Council should see that the new concern puts up something handsome in the city treasury. It probably means no benefit to consumers. The general experience of such competition is that one Company absorbs the other, or else a schedule of rates is adopted and no special advantage gained by consumers." There can be no getting around that sensible presentation of the case. However, we apprehend there is small likelihood of the strikers securing a foothold in Quincy.

IT is thought that Mr. George Day, a collector in the employment of the Clinton (Iowa) Gas Light and Coke Company, has been murdered.

(*Continued on page* 175.)

THE AMERICAN GAS LIGHT JOURNAL

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MONDAY, AUGUST 3, 1896.

(*Continued from page* 174.)

He left the office on the evening of July 3d to spend his vacation at his home in Le Claire, and has not been heard from since. His bicycle and other effects are in the Grand Hotel, Clinton, where he lodged. His accounts are perfectly straight, and when he bade his associates good-bye he was brimming over with health and mirth.

KATE LYNCH and Patrick Hayden have lodged suits against the Wallingford (Conn.) Gas Company, under which each seeks to recover $1,000 damages from defendant. Plaintiffs allege that they have been damaged in the sum named because of the loss of shade trees on their premises, the killing of which was occasioned by gas that escaped from breaks in the mains of the Company.

SOME time ago we announced that a party of Pittsburgh (Pa.) capitalists had applied for a charter to operate a gas works in the towns of Beaver and Bridgewater, Pa., the concern to be known as the Beaver Gas Company. Last week the application was withdrawn, and the Company will dissolve. Undoubtedly this action was determined upon because the proposed buildings of the National Masonic University will not be located in Beaver, as originally intended.

AT the annual meeting of the Greenfield (Mass.) Gas Light Company the officers chosen were: Directors, F. R. Allen, W. N. Washburn, W. A. Forbes, F. A. Pond and J. D. Safford; President, F. R. Allen; Clerk and Treasurer, Dana Malone.

THE Queen City Gas Company claims that it will be able to supply at least 100,000 cubic feet of gas per day from "its works at the foot of Court street." The price proposed to consumers is 80 cents per 1,000 cubic feet.

AT the annual meeting of the Easthampton (Mass.) Gas Company a semi-annual dividend of 3 per cent. was declared. The officers chosen were: President, E. T. Sawyer; Treasurer and Manager, George D. Manchester; Clerk, H. L. Clark.

WORK on the new gasholder for the Springfield (Ills.) Company is proceeding satisfactorily. It will be completed by September 1st.

Precaution against Electrolysis.

M. Potier, in an exhaustive article on this subject, which is printed in full in *L'Electricien*, discusses the precaution to be taken against electrolysis in the construction of electric railways. He considers the subject in general, showing that most of the trouble is caused by differences of potential between different parts of the rails, which when enough to overbalance the counter E.M.F. of polarization, produces a current through the earth; electrolysis of a damaging nature is certain if this voltage exceeds four or five.

He then discusses some of the methods proposed to obviate electrolysis, including much that is already well known in this country; in attempting to diminish the difference of potential between the extremities of the line it is not rational to use a copper conductor in parallel with the rail, for to do any good its conductivity should be double that of the rails, thus requiring an enormous amount of copper. He discusses a method of dividing the line into 10 sections, each a little over half a mile in length and connected to the generator with a wire of a certain resistance, which is the same for all. This would relieve the rails of any current more than the local one, and all the rails would have the same potential, the drop in voltage in any section of the rails being insignificant. This would be a solution of the problem, but it is at the sacrifice of greater first cost and a greater loss in the return circuit. By means of a diagram he investigates the distribution of the voltage if the cars are unequally distributed according to this system, and finds that the maximum voltage always remains below the dangerous figure.

He discusses the proposition of Farnham of using an auxiliary conductor connected to the rails with properly proportioned resistance wires. This is not as good as the other method in respect to the difference of potential, and is also more expensive in the cost of the copper. In the theory of the Farnham arrangement he states that there is a confusion between a loss of voltage and the resistance. He shows by means of diagrams that the different points along the rails will always be at different voltages.

He discusses the method of using boosters or machines for increasing the voltage, as one can then use a constant density of current in the cables, which is not the case in the other method described above; theoretically, the method of increasing the voltage is preferable, but the installation becomes much more complicated. Kapp recently proposed a similar solution, but the cost is not any less either for the copper or for the energy. The additional copper in the other method is practically compensated by the additional machinery, as also by the complication introduced.

The 3 wire system is spoken of very favorably. In his general conclusions he states that in lines which do not extend more than 6 miles from the station and for as many as two cars per kilometer, there is no need of having any fear of electrolytic action, but this can be obtained only at some sacrifice. For not more than 3 miles from the station no special precautions are necessary in a well-constructed line; for greater distances than 3 miles it does not seem economical to use as little as 500 volts, and it is then preferable to construct one or more sub-stations with transformers, as close to the line as possible, each for an additional section of 3 miles. The cost of the energy lost in these sub-stations would be less than of that in the return circuit, and the cost of the high tension feeders would not be as great. Most of the arguments in this article are accompanied by numerical examples. In an appendix he gives a table of convenient methods for calculating the loss of voltage along different points of a line.

Combination of Incandescent Lamp Interests.

The *Electrieal World* says it is reported that a combination has been effected between the various manufacturers of incandescent lamps to terminate the fierce competition hitherto existing in that line of industry. The concerns mentioned in this connection are the General Electric Company, the Westinghouse Electric and Manufacturing Company, the Bryan-Marsh Company, the Columbia Incandescent Lamp Company, the New York and Ohio Company and the Perkins, Beacon and Bernstein Companies.

Efforts to obtain some information from representatives in this city of some of the companies named failed to elicit anything of a definite character, it being their evident purpose to keep the matter as quiet as possible. From the replies made to several questions, however, we are led to the conclusion that there is truth in the report, and that the combine has been practically consummated. One gentleman stated that it was not true a combination had been effected, but when asked if one was likely to be made, replied that it was beyond his power of prophecy to say wha might be done.

The Market for Gas Securities.

Depression ruled in the general market for the week, sellers having been very much more in evidence than buyers, and the result was a lowering of values that seemingly discouraged investors hitherto staunch in their adhesion to the view that gas shares were good things to hold. Some investment stock in Consolidated was shaken out below 143, and the bulk of it (and the bulk was not over large) went into the hands of the people who have been absorbing the same right along. To-day's (Friday's) quotations show a net loss of over 4 points for the week in Consolidated. There is, however, no reason for the weakness; to the contrary, there is good reason why it should sell at figures better than any others yet recorded. Other city shares exhibited symptoms of weakness that were marked, because of declines recorded on extremely meager transactions. Mutual is said to be offered at 220, but we have no idea that an even hundred shares of it could be secured at 10 points higher. Again, Equitable is quoted at 185 to 195, and certainly no round lot of it could be secured at the offering price. In fact, quotations for city gas shares are at present no indication even of the difference between the views of buyers and sellers as to real values.

Brooklyn Union is offered at the absurdly low figure of 80. Par would not be too much for it. Chicago gas is somewhat better than a week ago, the quotations for to-day being 53 to 53¼. Bay State and Lacledes are dull and drooping, while Baltimore Consolidated is steady, with a tendency towards better figures. Consumers, of Jersey City, is offered at 78, at which figure it is undoubtedly a purchase. The Indianapolis series maintain their strength despite the uncertain money market, and Cincinnati gas has recovered from the doubt which seemed to cloud it a few days ago.

Gas Stocks.

Quotations by Cochran & Close, Brokers and Dealers in Gas Stocks.

35 Wall St., New York City.

August 3.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$35,480,000	100	142	143½
Central	500,000	50	150	..
" Scrip	220,000	..	100	.
Equitable	4,000,000	100	185	195
Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	114	.
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	..	220
" Bonds	1,500,000	1,000	100	102
Municipal Bonds	750,000	.	..	.
Northern	150,000	50	79	80½
" Bonds	150,000	1,000	..	98
New York and East River	5,000,000	100	25	30
Preferred	2,000,000	100	.	70
Bonds 1st 5's	3,500,000	1,000	95	98
" 1st Con. 5's	1,500,000	..	80	85
Richmond Co., S. I.	348,650	50	50	..
" Bonds	100,000	1,000	..	..
Standard	5,000,000	100	73	75
Preferred	5,000,000	100	100	102
Bonds, 1st Mortgage, 5's	1,500,000	1,000	109	112
Yonkers	299,650	50	130	
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	77⅛	80
" " Bonds (5's)	15,000,000	1,000	100	101⅛
Bay State	5,000,000	50	17⅜	17½
" Income Bonds	2,000,000	1,000	30	32
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	75	80
2d " " "	3,000,000	1,000	60	62
Buffalo Mutual	750,000	100	125	..
" Bonds	200,000	1,000	95	100
Central, San Francisco	2,000,000	..	95	..
Chicago Gas Co.	25,000,000	100	53	53⅛
Chicago Gas Lt. & Coke Co.				
Guaranteed Gold Bonds.	7,650,000	1,000	94	94¼
Columbus	1,069,000	..	..	65
1st Mortgage	1,085,000	..	..	96
Consumers, Jersey City	2,000,000	100	..	78
" Bonds	600,000	1,000	97½	99
Cincinnati G. & C. Co.	7,000,000	100	196¾	197
Consumers, Toronto	1,600,000	50	184½	187
Capital, Sacramento	500,000	50	..	41
Bonds (6's)	150,000	1,000	..	..
Consolidated, Baltimore	1,000,000	100	59	60½
Mortgage, 6's	3,600,000	..	107	107½
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490,000	..	..	..
Detroit	4,000,000	..	32	33
" Con. Bonds	4,312,000	..	..	82
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Fort Wayne	2,000,000	..	80	90
" Bonds	2,000,000	..	..	93
Hartford	750,000	25	..	145
Indianapolis	2,000,000	..	..	130
" Bonds, 6's	2,650,000	..	100	104
Jersey City	750,000	20	180	..
Lafayette Gas Co., Ind.	1,000,000	100	..	92½
Bonds	1,000,000	1,000	86	90
Louisville	2,570,000	50	..	..
Laclede, St. Louis	7,500,000	100	19½	19¾
Preferred	2,500,000	100	70	80
Bonds	9,034,400	1,000	90	91
Little Falls, N. Y.	50,000	100	..	100
Bonds	25,000	..	..	100
Montreal, Canada	2,000,000	100	200	.
Newark, N. J., Gas Co.	1,000,000	..	93	98
Bonds, 6's	4,000,000	..	123	..
New Haven	1,000,000	25	225	..
Oakland, Cal.	2,000,000	..	52	53¼
" Bonds	750,000	..	..	..
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	2,100,000	1,000	..	108
2d "	2,500,000	1,000	104	105
Peoples, Jersey City	500,000	50	..	175
Paterson, N. J.	.....	25	99	102
Rochester Gas & Elec. Co.	2,150,000	50	..	..
Preferred	2,150,000	50	83	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	93¾	95
St. Paul Gas Light Co.	1,500,000	100	67½	70
1st Mortgage, 6's	650,000	..	84	87
Extension, 6's	600,000	..	..	..
General Mortgage, 5's	2,400,000	.	88	90
Syracuse, N. Y.	500,000	25	..	..
Washington, D. C.	2,000,000	20	250	..
Western, Milwaukee	4,000,000	100	..	63
Bonds, 5's	3,556,000	.	85	90
Wilmington, Del.	500,000	5	188	190

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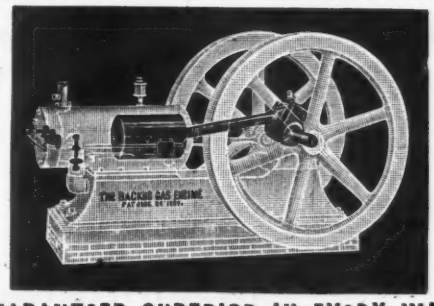

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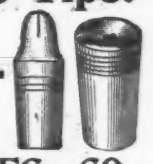

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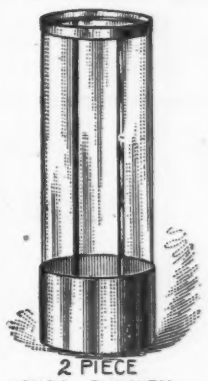

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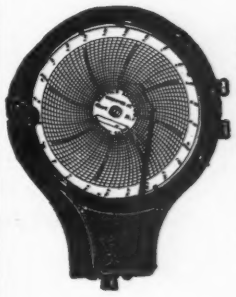

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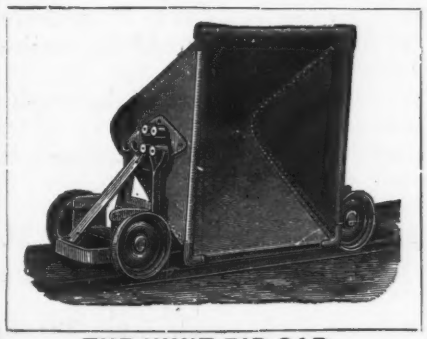

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INDUSTRIAL RAILWAYS

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THE ANDERSON Patent Cutter Carrying Link
Made in all sizes.
Will cut from 2 in. to 24 in.
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For Cutting Cast, Wrought Iron, Gas & Water Pipes.
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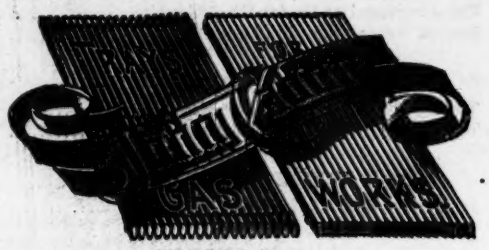

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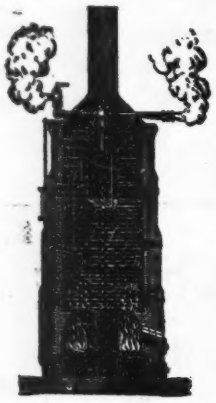

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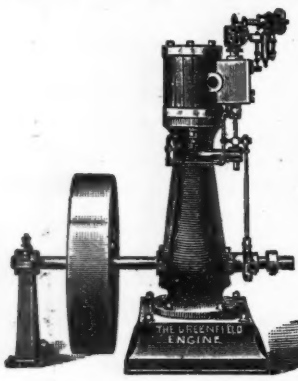

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Steam Engine Works.
Established 1874.
MANUFACTURERS OF
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ENGINES AND BOILERS.
Also Horizontal, Automatic and Variable Cut-off Engines
Sizes from 3 to 75 Horse Power.
Also Vertical and Horizontal and Marine Boilers.
Steam Pumps and Adams' Grate Bars.
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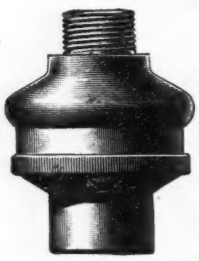

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Has been made by
WILDER'S VOLUMETRIC GOVERNORS.
They control the pressure at the burner, and deliver the quantity for which they are set regardless of high or low pressure in the supply.
WELSBACH LIGHTS are fully controlled, and the governors soon pay for themselves by preventing the breaking of mantles and chimneys. Thousands are already in use. Orders may be given to the Welsbach Co., or sent to ourselves.
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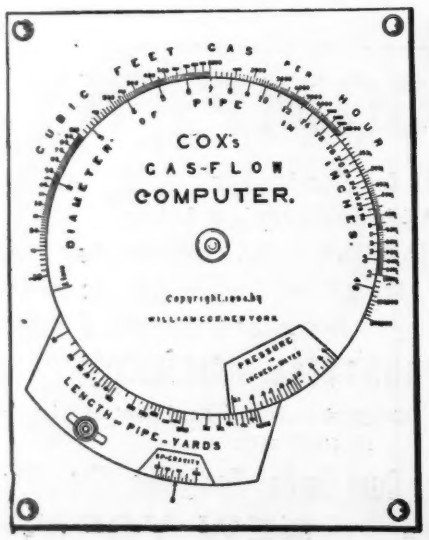

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4. Any suitable combination of the different factors of any problem, under all possible conditions, may be immediately found.

It Prevents Errors and Saves Hours of Tiresome Calculations.
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New and Improved Welsbach Light.

No. 34 Light, with No. 10 and No. 43 Opal Shade.

CAUTION!

BEWARE of counterfeit lights which are being offered in genuine Welsbach boxes. See that each box bears our trade mark, "WELSBACH," and that the seals are unbroken before you accept it.

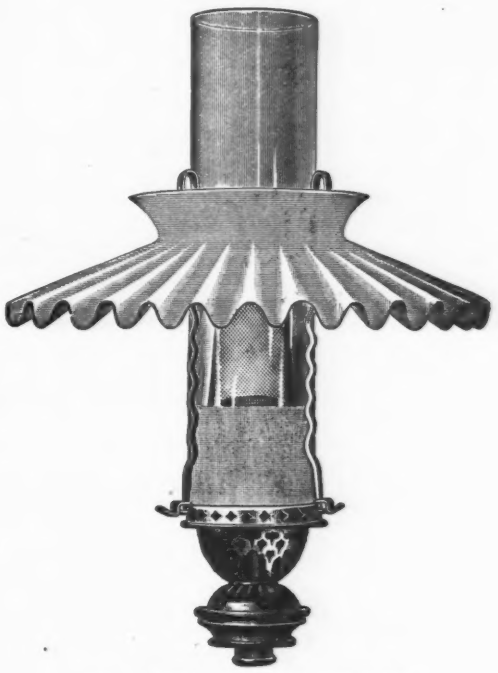
CAUTION!!

Persons dealing in counterfeit lights are liable to criminal prosecution, and a large number of indictments have already been found against such dealers.

All infringements of this Company's patents will be promptly and vigorously prosecuted, dealers and users being equally liable. This Company will prosecute all parties in whose possession infringing lights are found.

This notice is given in view of an effort now being made to introduce into this country infringing lights made in Germany, the sale of which, there, has been prohibited by the recent decision of the German Patent Office sustaining the validity of the Welsbach patents.

For your own protection, see that you get the genuine Welsbach light, as both the counterfeit and the infringing lights are greatly inferior.



No. 34 Light, with No. 74 Opal Shade.

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Coal and Water Gas Plants,

OWN SYSTEM.

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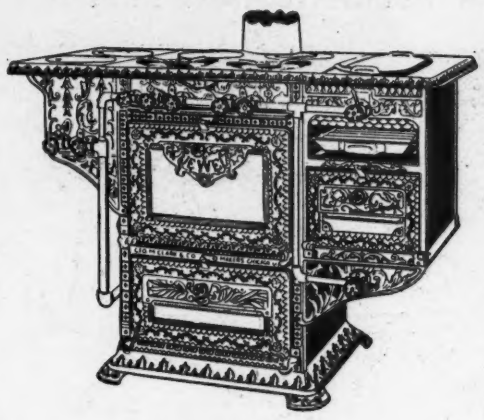

A few of the world's best Gas Stoves. All prominent demonstrators of cooking use them. Nine-tenths of the Chicago apartment houses are furnished with the same . . . . . .

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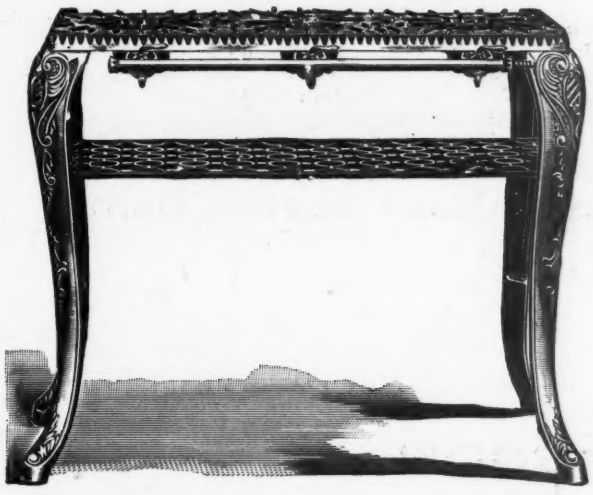

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have special inducements to offer
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for the balance of the summer. Write to
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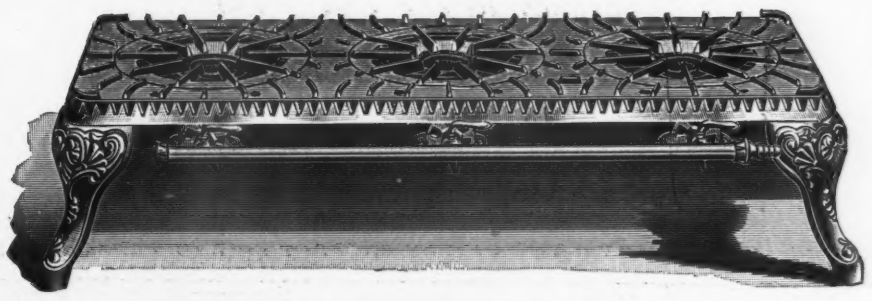

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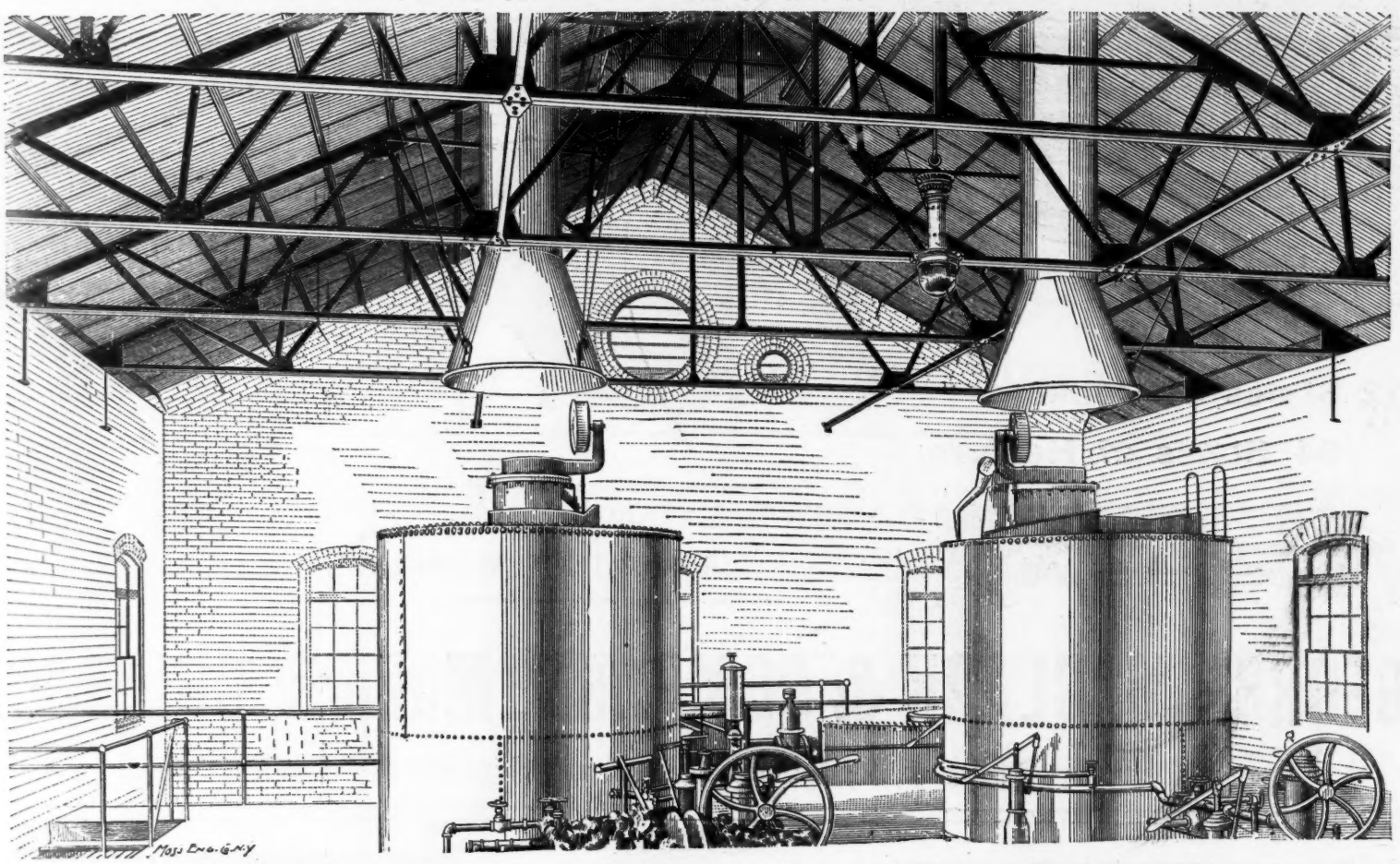

The above illustration is taken direct from a photograph, and shows the construction of an Iron Truss Roof designed and built by us for the Providence Gas Light Company, at Providence, R. I. The building is 40 ft. in width by 100 ft. in length, the side walls being of brick and the roof being entirely of iron—that is, iron trusses and iron purlins covered with corrugated iron. The building is ventilated by our Improved Ventilators, extending the full length of the roof, with side shutters opened and closed by cords from the floor. No woodwork is used in any way about the construction of the building.

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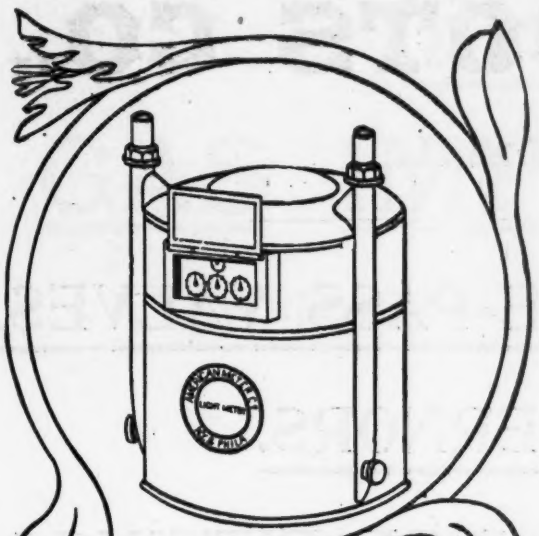

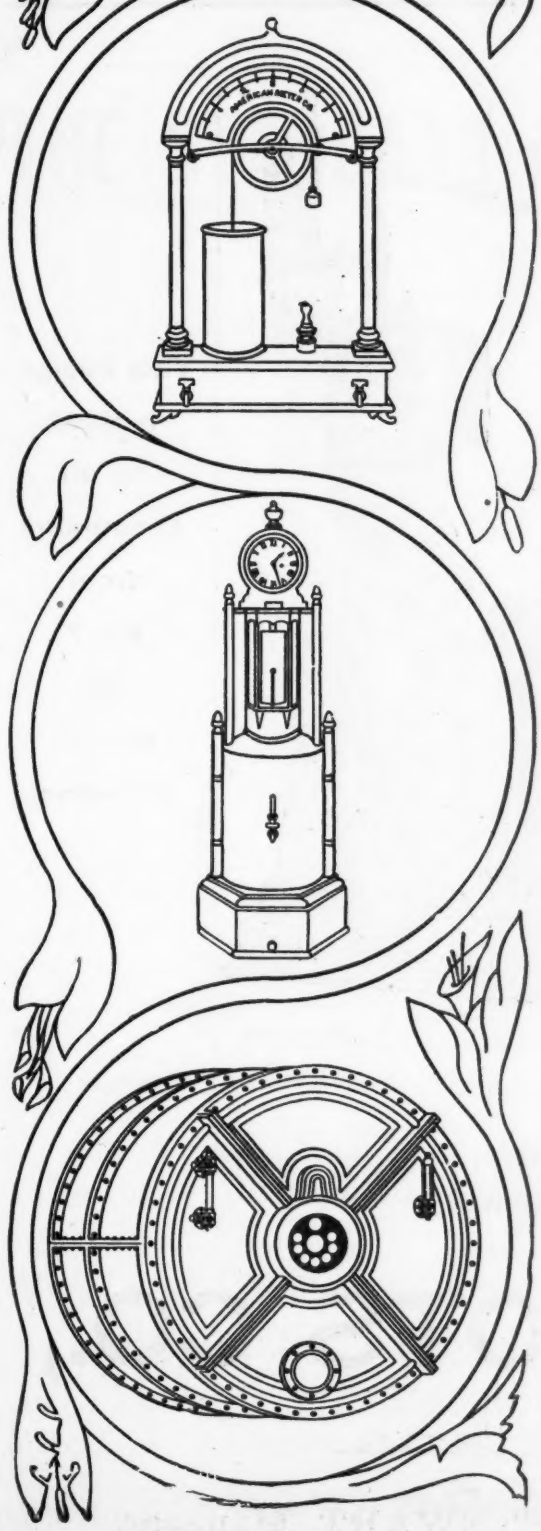

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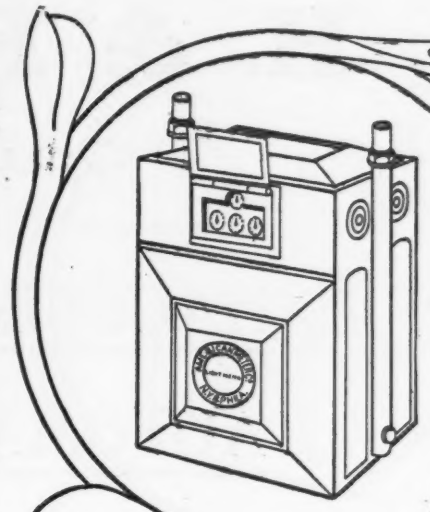
PUBLIC LIGHTING TABLE.

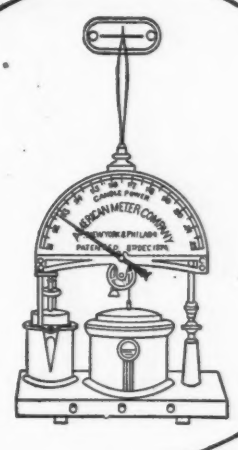
AUGUST, 1896.

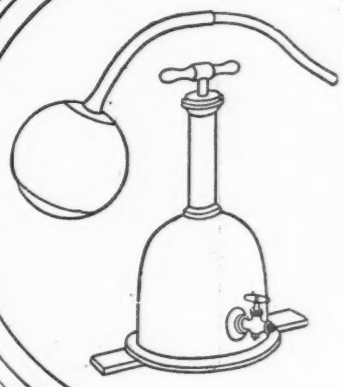
Day of Week.	Table No. 1. Following the Moon. Date.	Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Sat.	1	7.50 PM LQ	11.40 PM	7.10	3.30
Sun.	2	7.40	12.10 AM	7.10	3.30
Mon.	3	7 40	12.50	7.10	3.30
Tue.	4	7.40	1.50	7.10	3.30
Wed.	5	7.40	4.00	7.10	3.30
Thu.	6	7.40	4 00	7.10	3.45
Fri.	7	7.40	4.00	7.10	3.45
Sat.	8	7.40 NM	4.00	7.10	3.45
Sun.	9	7.30	4.10	7.10	3.45
Mon.	10	7.30	4.10	7.10	3.45
Tue.	11	7.30	4.10	7.10	3.45
Wed.	12	7.30	4.10	7.10	3 45
Thu.	13	8.10	4.10	6.55	4.00
Fri.	14	8.40	4.10	6.55	4.00
Sat.	15	9.20 FQ	4.10	6.55	4.00
Sun.	16	10.10	4.20	6.55	4.00
Mon.	17	11.00	4.20	6.55	4.00
Tue.	18	12.10 AM	4.20	6.55	4.00
Wed.	19	1.10	4 20	6.55	4.00
Thu.	20	2.20	4.20	6 45	4.10
Fri.	21	No L.	No L	6.45	4.10
Sat.	22	No L. FM	No L.	6.45	4.10
Sun.	23	No L.	No L.	6.45	4 10
Mon.	24	7.10 PM	8.10 PM	6.45	4.10
Tue.	25	7.10	8.30	6.45	4.10
Wed.	26	7.10	8.50	6.45	4.10
Thu.	27	7.10	9.20	6.30	4.20
Fri.	28	7.10	9.40	6.30	4.20
Sat.	29	7.10	10.10	6.30	4.20
Sun.	30	7.00 LQ	10.50	6.30	4.20
Mon.	31	7.00	11.30	6.30	4.20

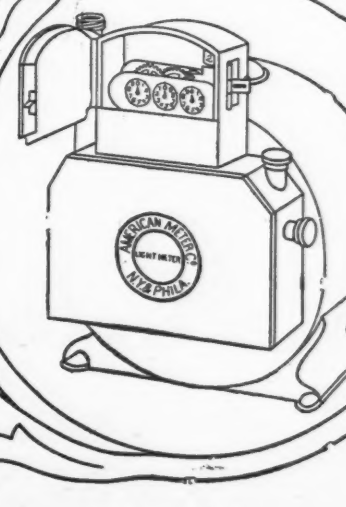
TOTAL HOURS LIGHTING DURING 1896.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	220.40	January	423.20
February	207.00	February	367.40
March	193.00	March	355.35
April	174.10	April	298.50
May	164.00	May	264.50
June	142.10	June	234.25
July	142 10	July	243.45
August	150.50	August	280.25
September	163.00	September	321.15
October	193.10	October	374.30
November	207.00	November	401.40
December	237.30	December	433.45
Total, yr.	2194.40	Total, yr.	4000.00









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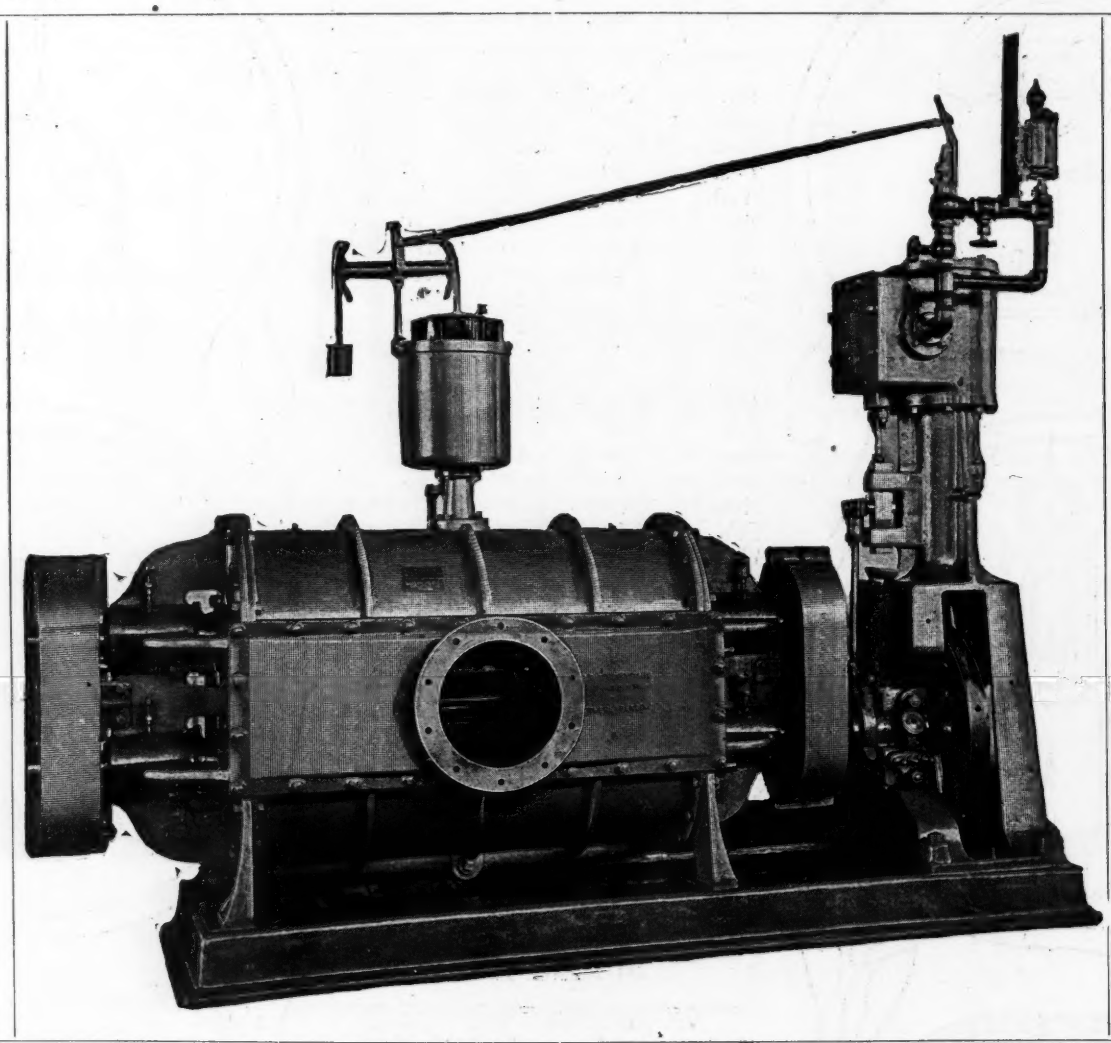
GAS EXHAUSTERS. BYE-PASS VALVES.

AUTOMATIC GAS GOVERNORS.

GAS VALVES. PIPE FITTINGS.

New Design of Direct Connected Engine and Exhauster on Same Bedplate.



This Design is Used for all Exhausters from No. 7 to No. 10, Inclusive.

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Estimates submitted on application.

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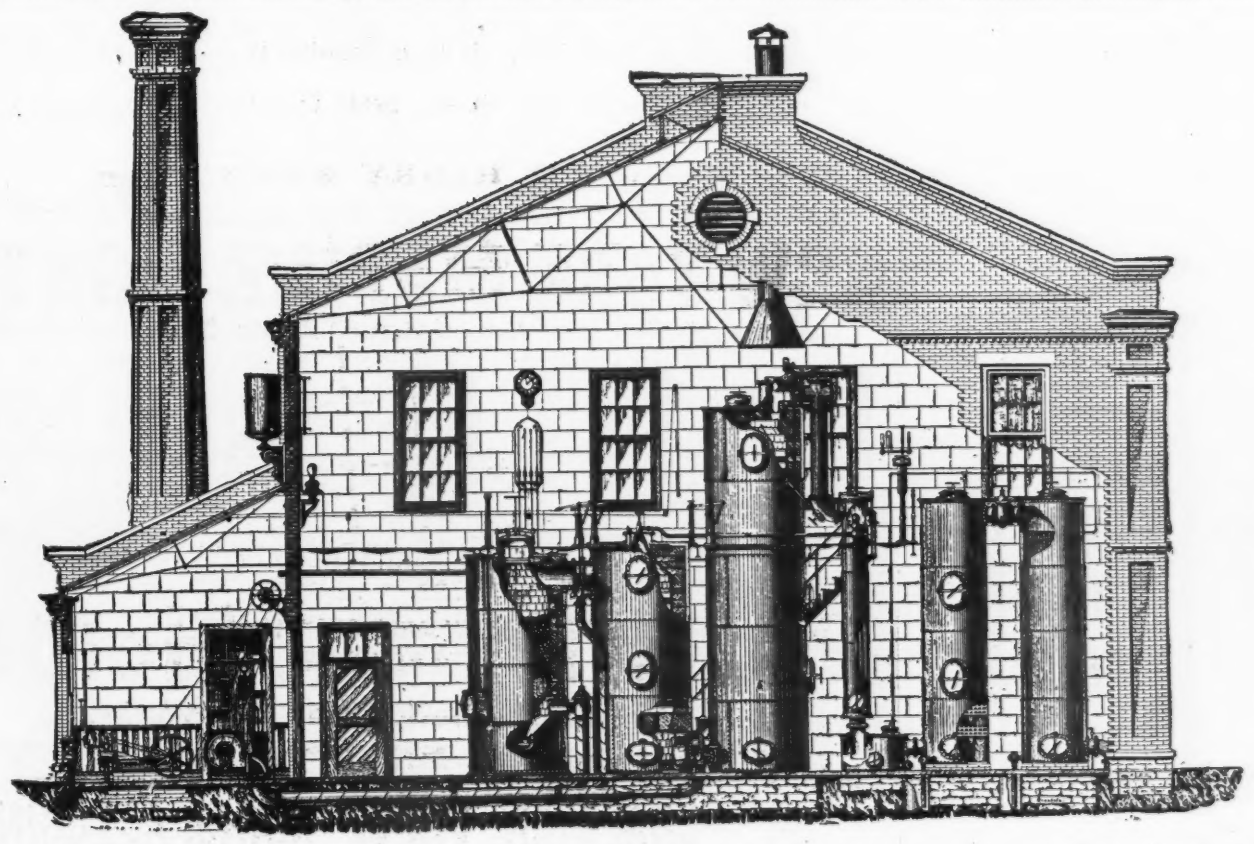

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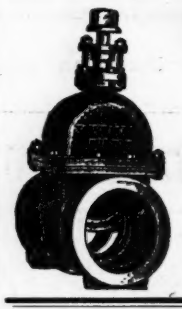

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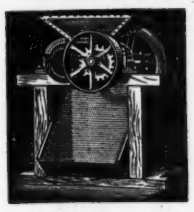

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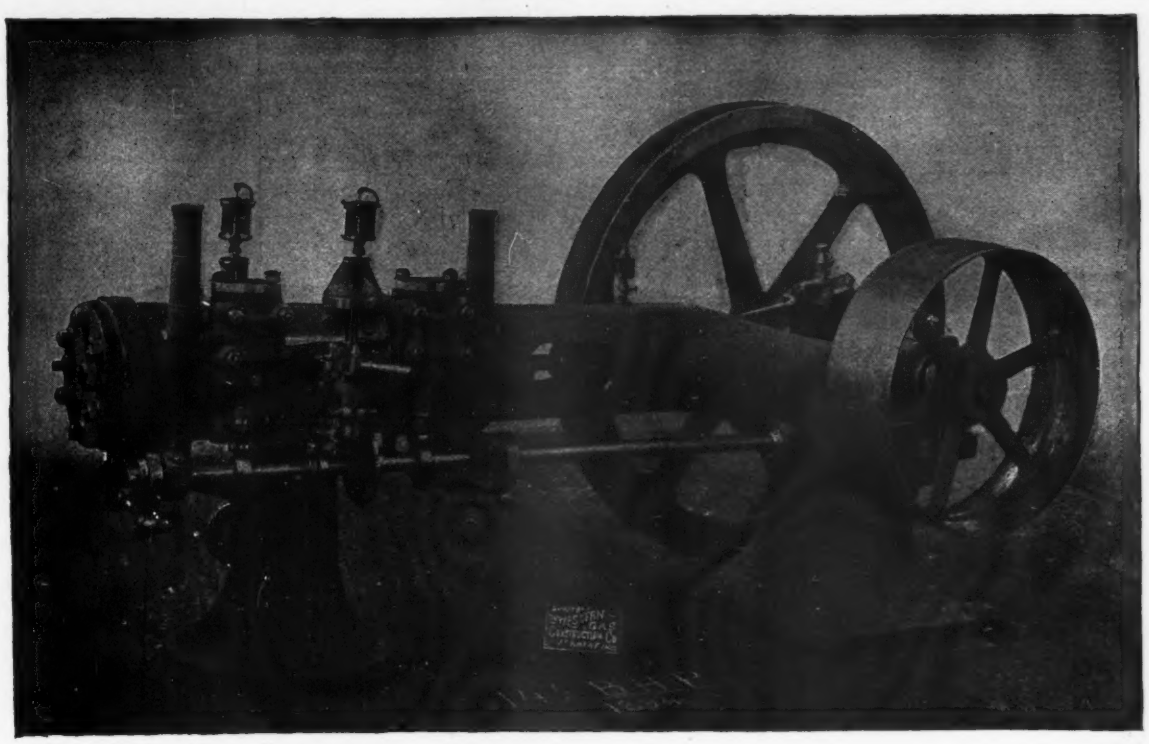

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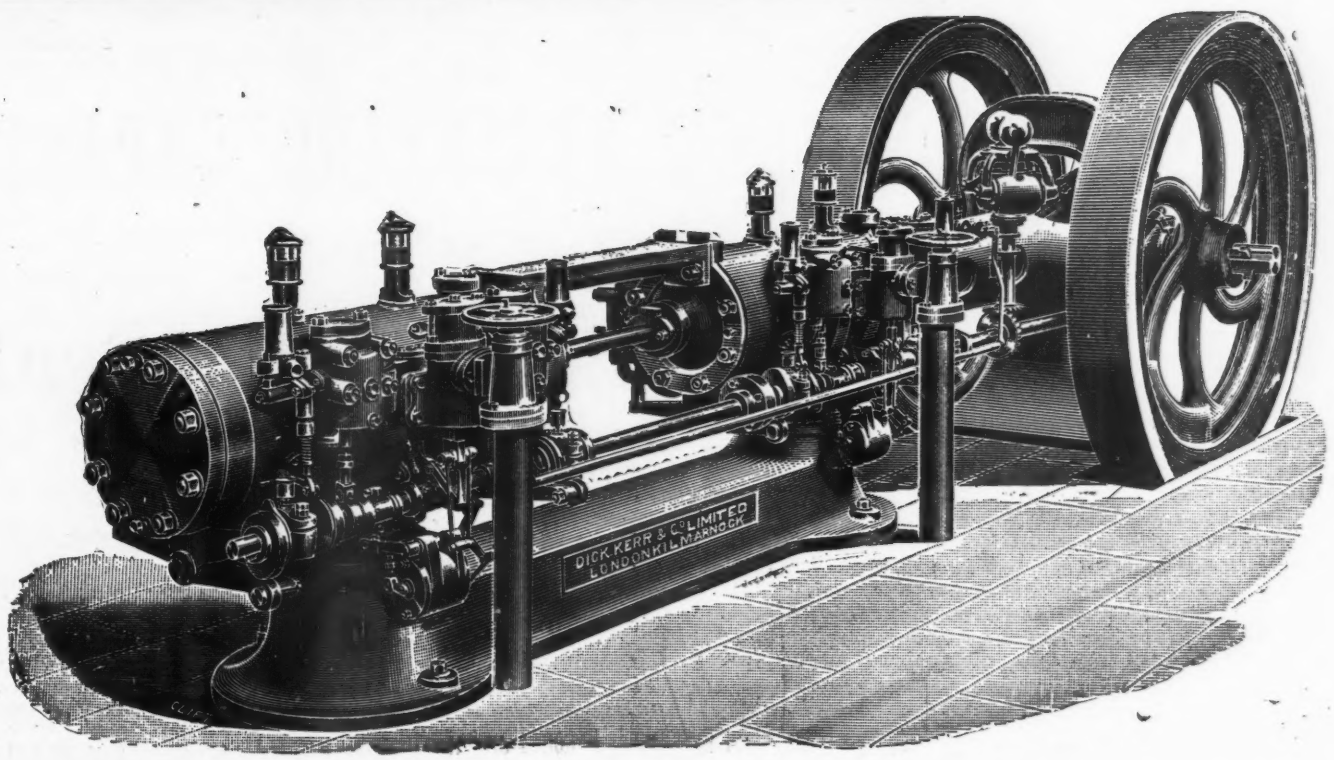

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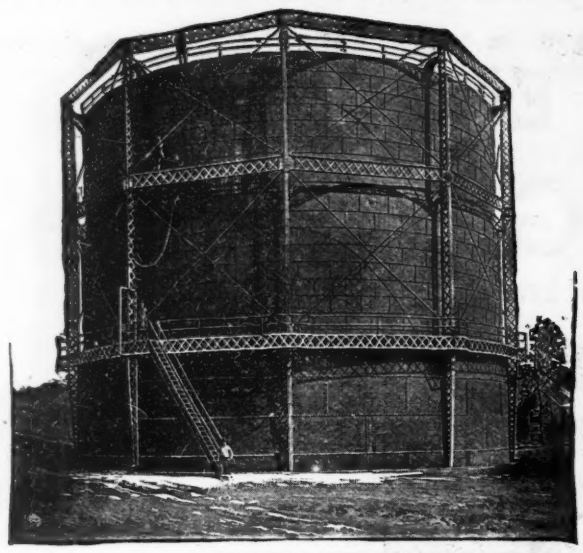

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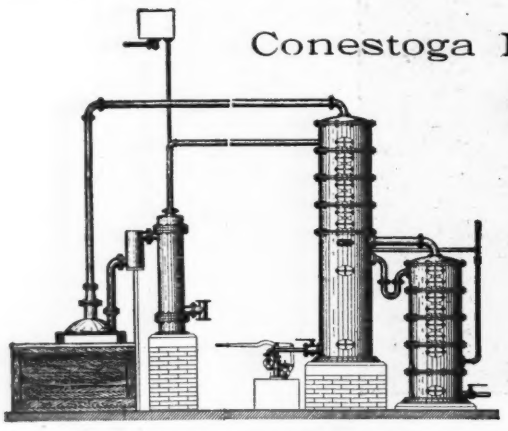

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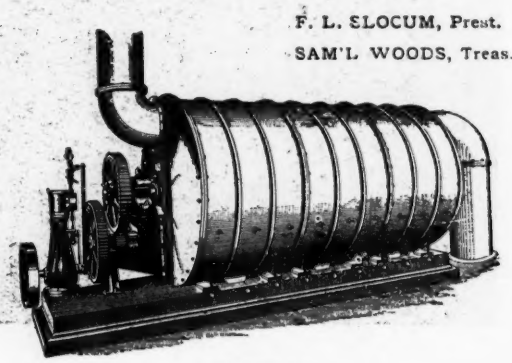

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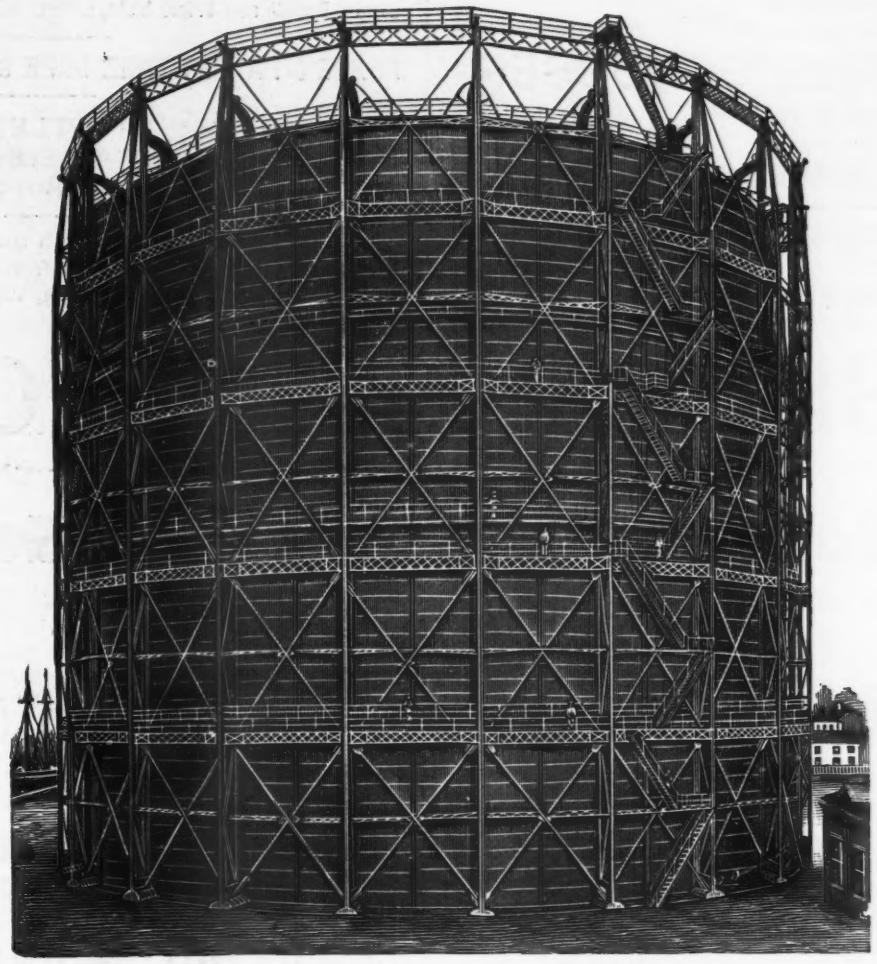

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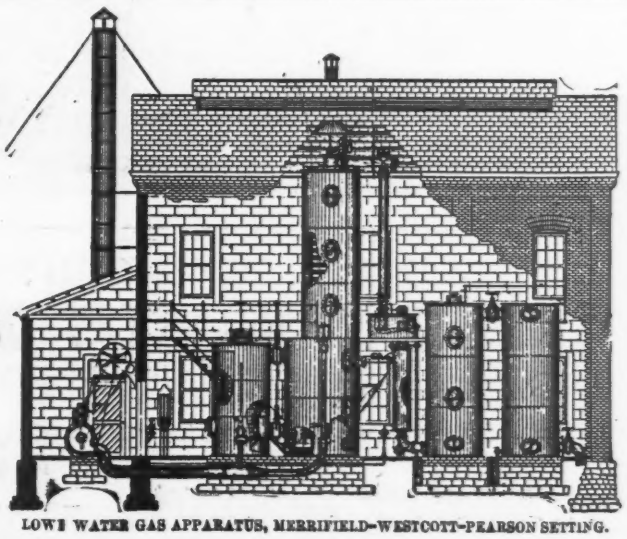

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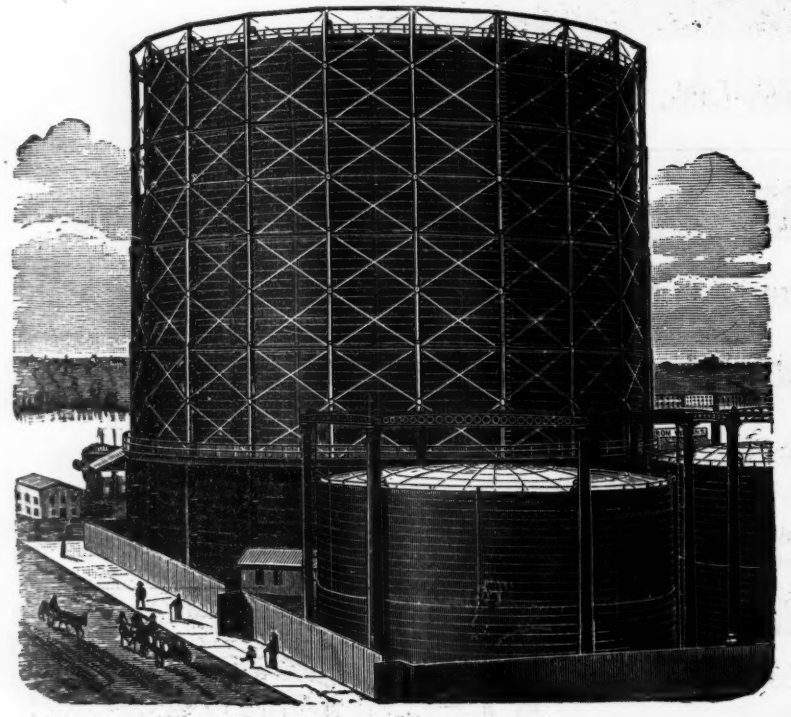

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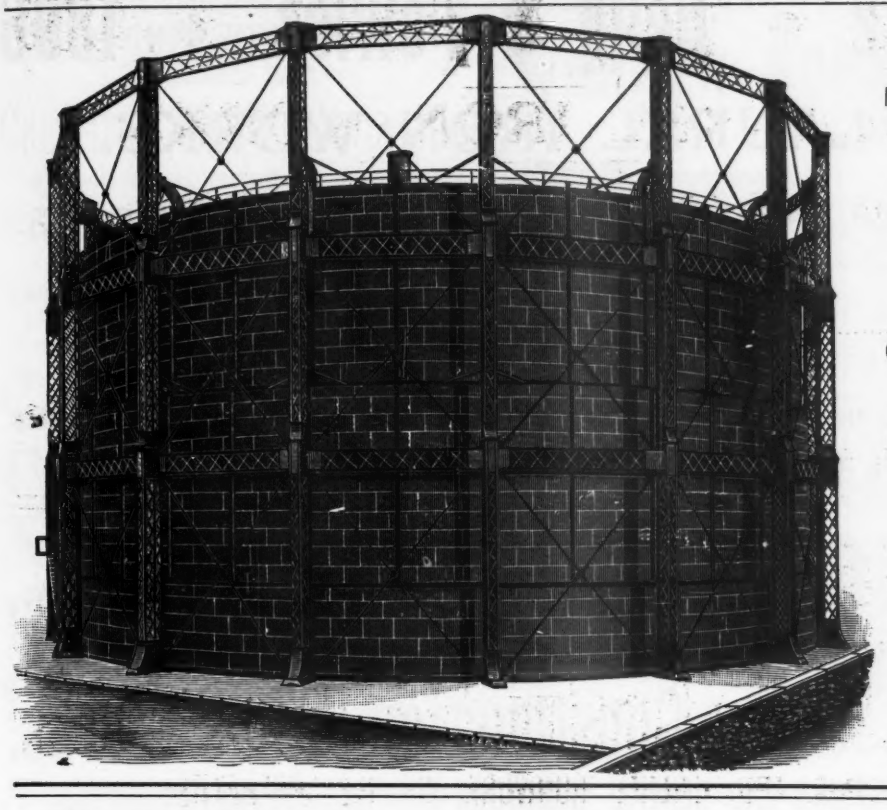

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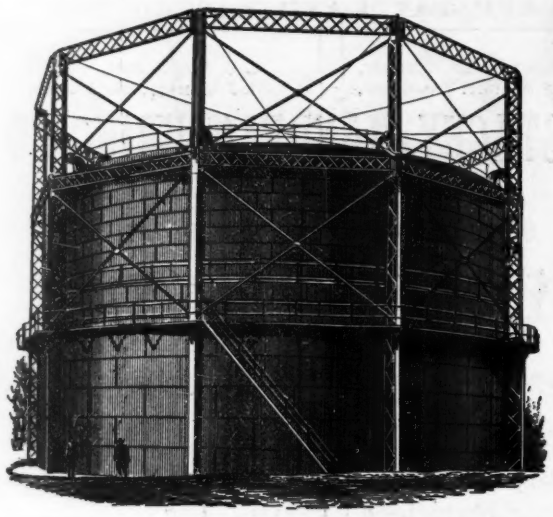

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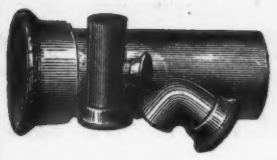

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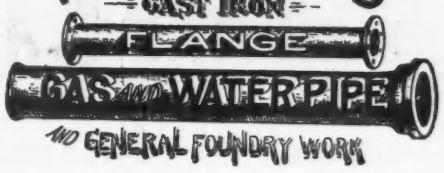

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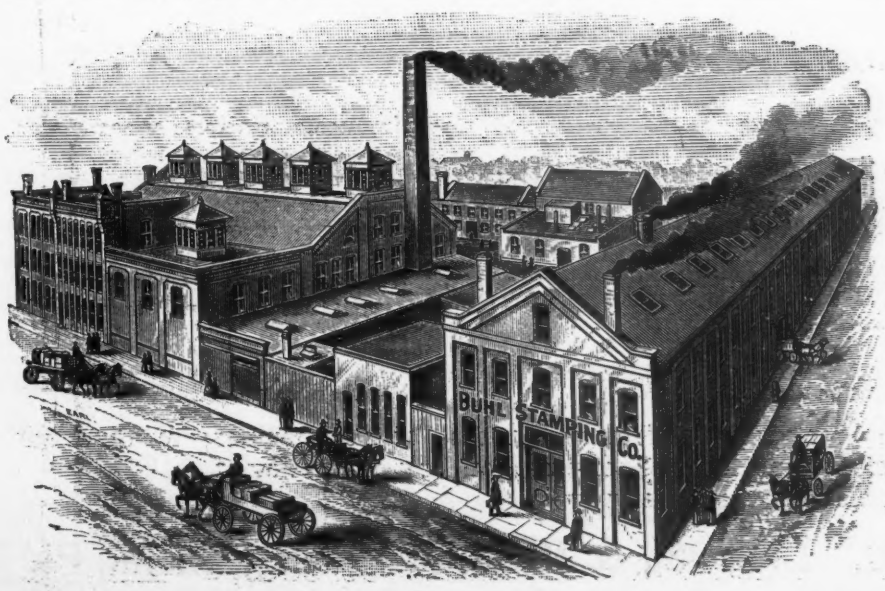

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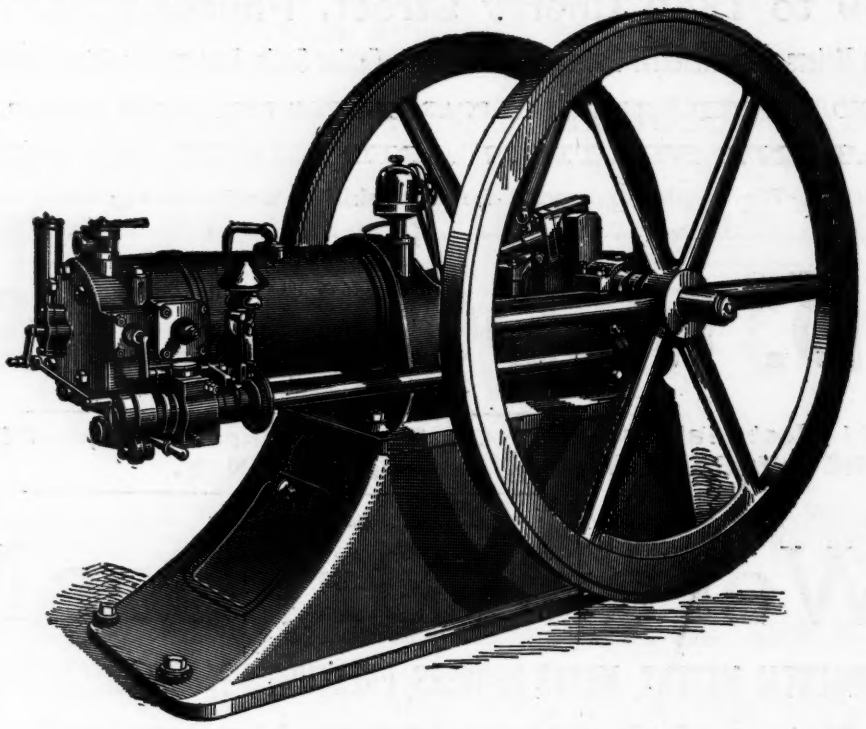

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